Industry and Power

December 1954

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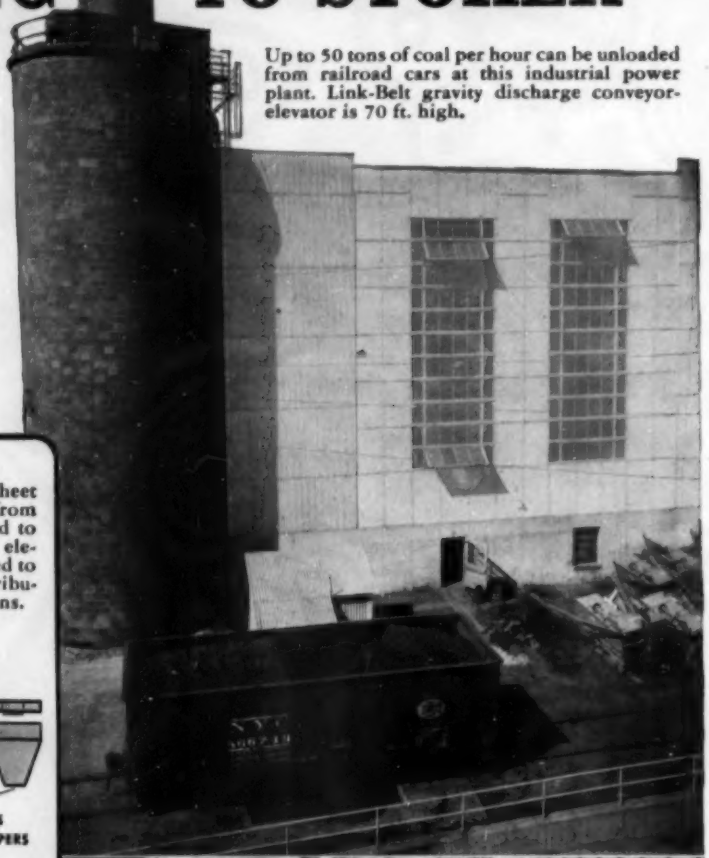
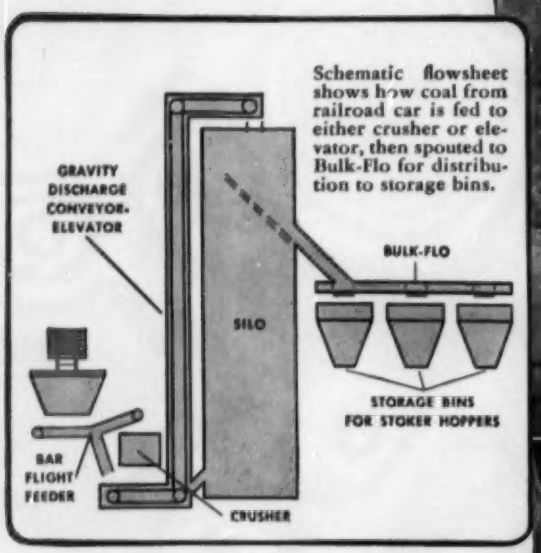
FROM SIDING TO STOKER--

it's Link-Belt for low-cost coal handling



Up to 50 tons of coal per hour can be unloaded from railroad cars at this industrial power plant. Link-Belt gravity discharge conveyor-elevator is 70 ft. high.



Schematic flowsheet shows how coal from railroad car is fed to either crusher or elevator, then spouted to Bulk-Flo for distribution to storage bins.

Simple and effective, this Link-Belt bar flight feeder travels at 45 ft. per min., operates on 45-ft. centers.

WHETHER your coal handling requirements are large or small—Link-Belt can give you a system that assures top efficiency. A complete line of quality equipment is backed by unequalled engineering experience. And Link-Belt will carry through the entire job from planning to erection, if desired. See your Link-Belt representative for all the facts, or write for Book 2410 that shows the latest in modern power plant layouts.

Dust-tight Link-Belt Bulk-Flo feeder-conveyor delivers coal to any of three stoker storage bins at 15 tons per hour.

LINK-BELT

COAL HANDLING EQUIPMENT

13.405

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

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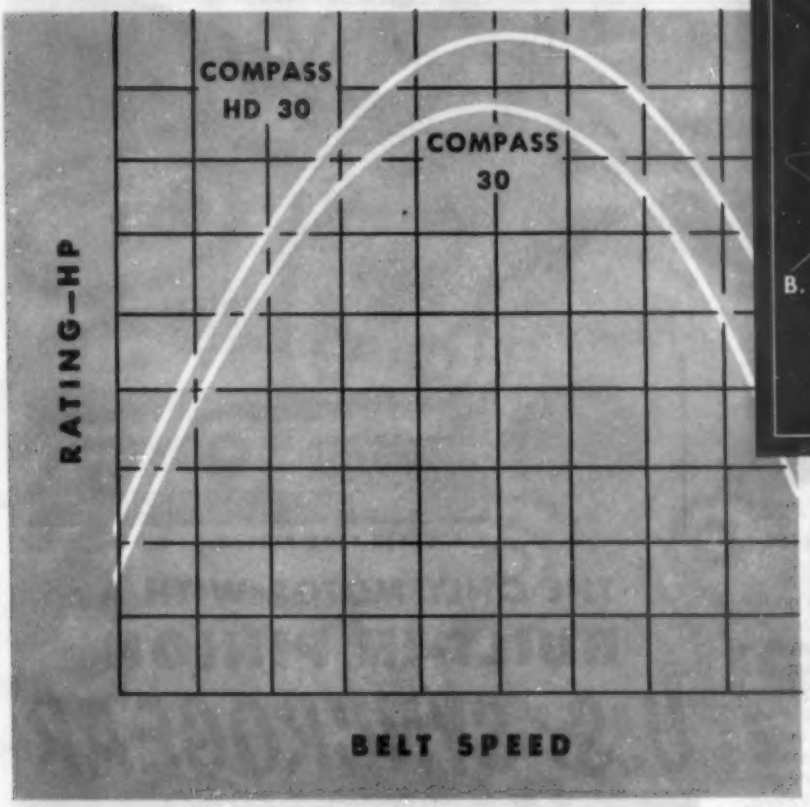
up to 26% THINNER—up to 60% STRONGER

New COMPASS HD Transmission Belts with 3-T Cord



GOODYEAR INDUSTRIAL PRODUCTS
GTM-Specified
COMPASS HD TRANSMISSION BELT
for heavy-duty, high-shock-load drives
A. Cord-covering sleeve tape of tough, high-stretch fabric resists wear
B. Multi-strand cords of chemically produced 3-T filaments laid in neutral plane carry the load. Cords on opposite sides of belt axis are twisted in opposite directions to insure true running
C. Thinner cross-section permits better flexing — longer life over small pulleys

HERE'S an example of the difference in COMPASS HD versus regular COMPASS CORD Transmission Belts! The upper curve depicts the horsepower ratings for the new COMPASS *HD* 30 belt. The lower curve represents those of the standard COMPASS 30 belt. You get all that added horsepower capacity at no added cost and in a thinner, more flexible belt.

In 1929 the G.T.M.—Goodyear Technical Man—introduced the first major improvement in flat transmission belt design — the COMPASS Endless Cord Belt. Low stretch, longer flex life and higher horsepower ratings with no danger of splice failures or ply separations were, and still are, the chief advantages of this much superior belt.

Today the G.T.M. takes another great step forward with a further refinement of the endless-rope-cord principle—the use of Triple-Tempered (3-T) Cord in the new COMPASS HD belts. 3-T Cord is synthetic cord from which the surplus stretch has been removed by an exclusive triple-action tempering process involving the application of carefully controlled Tension at an exact Temperature for a specific period of Time.

Triple Tempering sets the cord at the point of maximum resiliency and strength — only the surplus stretch is removed — flexibility is not hindered. The end result is a thinner, stronger belt having less stretch for more efficient power transmission, longer wear and better flex life on the smallest pulleys or reverse bends. And you pay no more for a COMPASS HD belt than for its cotton cord predecessor. For details see the G.T.M., your Goodyear Distributor or write Goodyear, Industrial Products Division, Akron 16, Ohio.

YOUR GOODYEAR DISTRIBUTOR *can quickly supply you with Hose, Flat Belts, V-Belts, Packing or Rolls. Look for him in the yellow pages of your Telephone Directory under "Rubber Products" or "Rubber Goods."*

GOODYEAR

THE GREATEST NAME IN RUBBER

Compass—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

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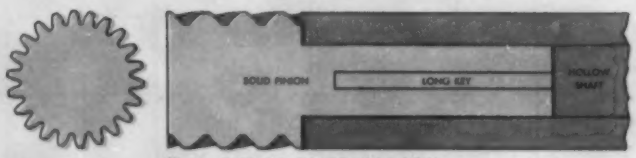
In your opinion, which pinion?

. . . for longest life in a gearmotor

ORDINARY SHELL TYPE PINION



U. S. SOLID TYPE PINION

In an internally geared motor the pinion on the motor shaft is the vital link between motor and gearing. It's the fastest, but smallest gear, so it must be extra strong, free from vibration and forever tight. Now compare the U. S. Syncrogear motor pinion with the ordinary type. Note the extra large section area of the U. S. design. It has a long solid shank that anchors into the motor's hollow shaft, whereas the ordinary shell type has a small section area, short keyed.

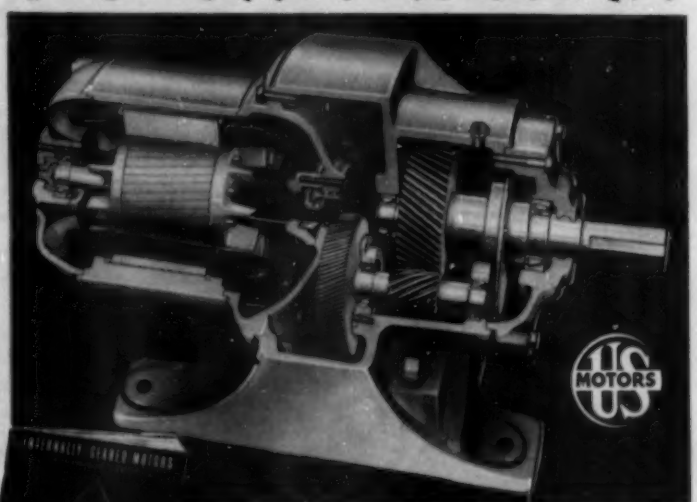
Obviously the U. S. design is most substantial, longer lasting, more resistant to deflection and can carry high speed loads far more safely than common designs. All the gears are deep-hardened and shaved to exact tolerances in the U. S. plants.

Added life lengthening features

The rugged pyramidal case supports the motor and gear train and all castings are normalized to insure permanent alignment and to prevent distortion. The motor windings are asbestos-protected to avoid carbonization and guard against burnouts. All moving parts are completely enclosed for weather and dust protection and confined within the least cubical dimensions on a single mounting. ¼ to 30 h.p.; 10 to 10,000 r.p.m.

THE ONLY MOTOR WITH A BUILT-IN PINION

U. S. SYNCROGEAR



FREE 16-PAGE DESCRIPTIVE BOOKLET GIVES ALL THE FACTS

Interesting multi-colored Booklet presents engineering facts you should know about geared motors, and illustrates the various U. S. Syncrogear types. Mail the Coupon for a copy. No obligation.

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Industry and Power

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acorns

. . . recently announced . . . worth watching

No Moving Parts

• A new pump, operating on an electromagnetic principle and with no moving parts or packing glands, has been designed to move liquid metals within cooling or heating systems, to force liquid metals into forms in die-casting operations, and for general usage — including applications in industrial atomic energy operations. The pump can be operated from 60-cycle a-c voltages.

Turbine Blade Temperatures

• A complete instrumentation system for remote indication of gas turbine blade temperatures has recently been designed by the National Bureau of Standards. Tests on turbines under actual operating conditions indicate that temperature measurements can be made to an accuracy of better than ± 25 F at temperatures up to at least 1400 F. More conventional methods used on lower speed machinery are not applicable at usual gas turbine speeds and temperatures.

Phosphate Coatings

• Advances in the technology of applying phosphate coatings to metallic surfaces are described in a detailed series of research reports by the Army's Ordnance Corps. Phosphate coatings are widely used to increase the corrosion resistance of metal surfaces. Produced in a high acid bath, the deep etch of the surface and the coating is an excellent holder of lubricants. Coated pistons, for example, can be driven at a faster rate during the break-in period without the danger of galling and resulting damage to the cylinder walls.

Plastic Pipe Patch

• A new plastic pipe patch has partially solved the problem of emergency repair of ruptured or damaged piping. The plastic patch is easily applied and can, for instance, put a ruptured fire main system, sprinkler line, or water cooling system back into operation in approximately 30 minutes. Tests so far indicate that plastic pipe patches should be used only on salt or fresh water piping where pressures do not exceed 300 lbs and temperatures are not above 200 F. However, tests are now being conducted to find methods of applying this patch to lines carrying steam, gasoline, and other materials. The maximum patch life is unknown as yet, but experience has shown that a properly applied patch will last till permanent repairs are made.

Spectrograph Tests

• A spectrograph to determine trace elements in oil taken from crankcases of diesel locomotives was put into service recently at the Missouri Pacific central test laboratory in St. Louis. The new equipment will be used later to test other materials subject to atomic breakdown under heat.

Chrome Plated Cylinders

• More than $15 million has been saved in the cost of aircraft engine cylinder walls since the Navy adopted a process of chromium plating the walls of engine cylinders to extend their service life. The process has increased the service life of engine cylinders from 1200 to more than 3000 hours of operation. By eliminating corrosion of the cylinder bores, the coating reduces wear by 50 percent.

Portable Water Spray

• A portable water spray fire extinguisher, developed at the Naval Research Laboratory for submarine use, should also be useful on fires in interior spaces where lack of control over ventilation is a problem. The extinguisher has been tested at the Laboratory on Class A fires—paper, wood, cloth; Class B fires—fuel oil; and Class C fires — energized electrical equipment.

Prospects for Longer Life

• The life of exhaust systems and parts subject to high temperatures can now be increased from three to five times through the application of high temperature ceramic coatings in such fields as automotive, marine, and heating equipment. This new development has been made possible by coating the entire exhaust system, both inside and out, with a 0.001 to 0.002 in. thick high temperature ceramic which resists corroding gases and temperatures up to 2200 F.

Chapman List 960

...for EVERY Small Forged Steel Gate Valve Application

Month after month, Chapman List 960 Valves deliver the goods on more different jobs than any other small forged steel gate valves. And maintenance charges are few and far between even under the toughest conditions.

The wedge gate faces — hardened to 800 Brinell by Chapman's exclusive Malcomizing process — won't seize or gall. Seat rings are hardened stainless steel, for minimum wear, and are easy to replace. Also, the bolted follower has no exposed threads on the yoke to corrode.

For every small forged steel gate valve application, specify Chapman List 960. Sizes from ¼″ to 2″, either rising stem with yoke (shown) or rising stem with inside screw. Bonnet joint is ground metal-to-metal or gasketed, depending on application. Pressure range is from 380 psi at 1000°F to 2000 psi at 100°F. For higher ratings, specify List 990.

List 960 is made in various alloys and combinations of alloys as listed in Catalog No. 10. Write for your copy today.

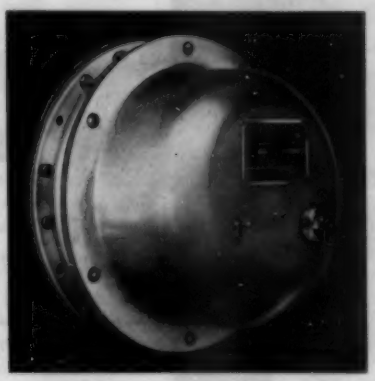
The CHAPMAN Valve Manufacturing Company
INDIAN ORCHARD, MASSACHUSETTS

Circle 504 on Reply Card for more data

new equipment

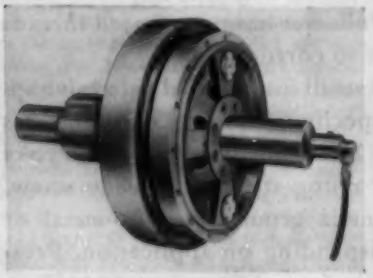
. . . new developments

M10 THIS COMBINED cutoff and safety switch unit for cooling tower fans offers effective protection against both extensive vibration damage and personnel accidents, according to the manufacturer, Santa Fe Tank & Tower Co. Known as the Dual-Safety Switch, it prevents costly tower repairs resulting from blade breakage and consequent equilibrium loss on fans. Sensitivity is easily set by a manual adjustment. Switch can be used on any tower.

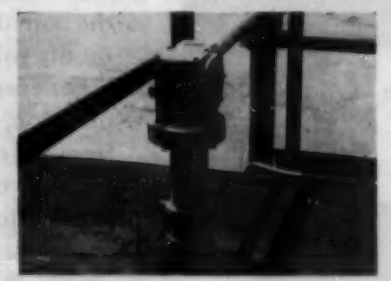


M12 THE BIN LEVEL indicator system introduced by The Bin-Dictator Co., incorporates a built-in bull's eye signal light for use in installations requiring a signal that can be readily seen by the operator. Designated Model AL Special Bin-Dicator, it is a complete, visual signal system in one package. It comes completely assembled and ready for connection to the user's power source and is particularly suitable for use on hoppers.

M14 FOR CONTROL of the many continuous fuel fired process applications requiring a true proportional relationship between fuel input and continuously measured temperature, Barber-Colman Co., Wheelco Instruments Div. has developed the Model 405 Capacitrol. Applications include use with heat treating furnaces, drying ovens, and melting furnaces. Incorporated in the instrument is means for manual "droop" correction.



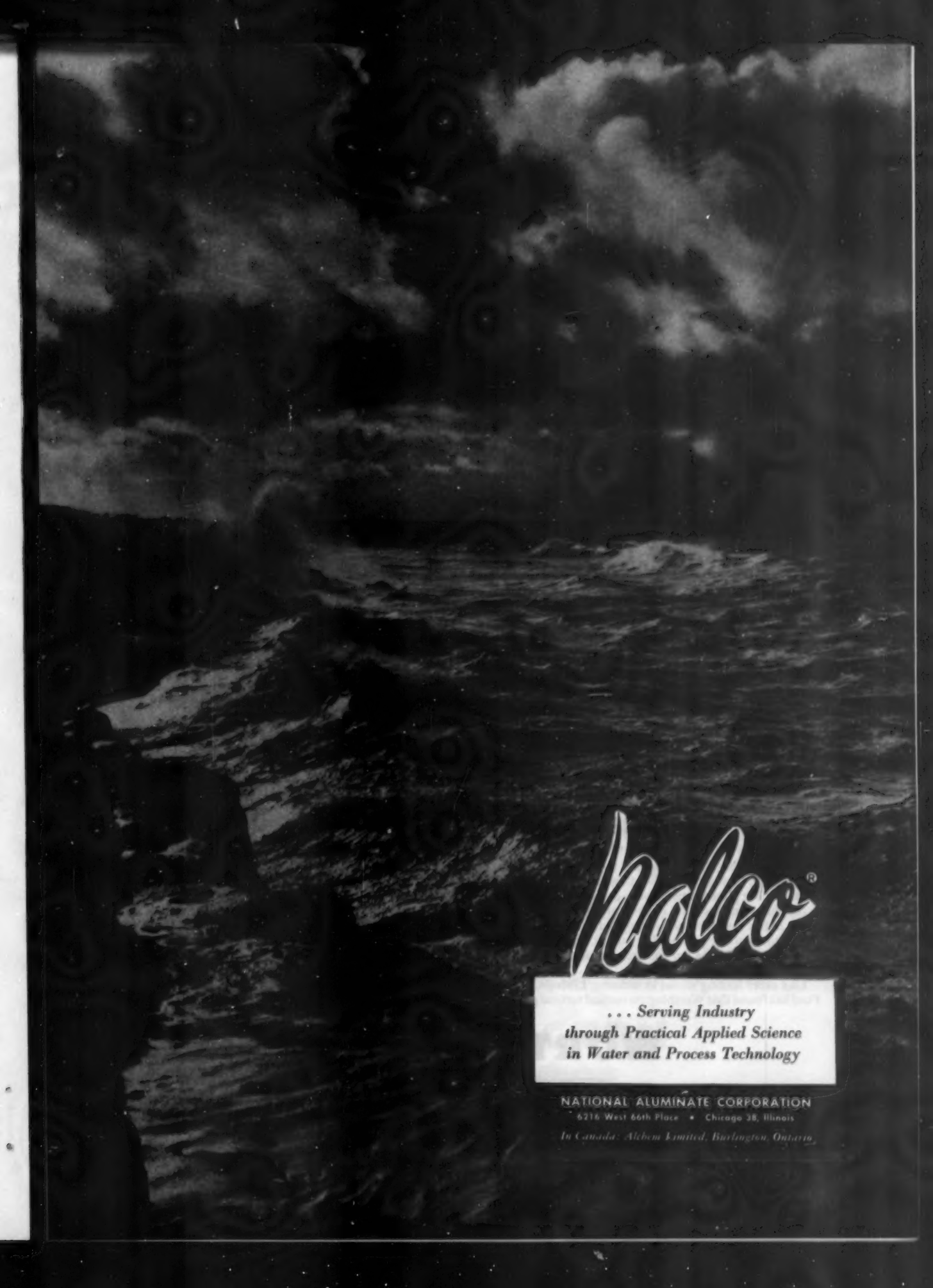
M11 AN AIR CLUTCH, known as the Air-Grip, introduced by Dodge Manufacturing Corp., features quick action and ease of control. Greater sensitivity is said to provide finger-tip control with an ability either to inch the clutch or to throw it into full engagement, as required. Provision is also made for mechanical engagement of the clutch in case the air supply fails. The unit can be used to replace Dodge or other mechanical clutches.



M13 PETROLEUM PRODUCTS and many other difficult liquids at temperatures up to 175 F can be measured with the Gilbarco Electronic Gauge, according to Gilbert & Barker Mfg. Co. Designed for maintaining accuracy of ±1/16 in., the gage is actuated by electronic signals operating a servo-motor. Potentiometers and gearing can be mounted inside the motor box if remote transmission is desired. Null-balance receiver is available.

M15 SIMPLE but accurate tube gage tool has been designed by Elliott Co. to measure the inside diameters of small tubes and tube sheet openings in condensers and heat exchangers. For use in conjunction with tube rolling operations, the gage has a large dial with graduations marked for heat exchanger and condenser tubes. It can be read directly in thousandths of an inch and enables tube expanders and controls to be set accurately.

NOTE—Each new product item has a key number for your convenience in asking for additional, detailed information. Circle this number on Reply Card, pages 34/35 & 90/91.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WATER FOR PROCESSING FIBER GLASS is brought from deep wells by these six Worthington vertical turbine pumps at the Libbey-Owens-Ford factory in Parkersburg, W. Va. Any type of drive can be used with the pumps.

Daily, these pumps help produce enough glass filament to circle the globe 1700 times!

Libbey-Owens-Ford uses Worthington vertical turbine pumps in manufacture of fiber glass

In Parkersburg, West Virginia, the new Fiber-Glass Division of Libbey-Owens-Ford spins over 42 million miles of fiber glass filament every day.

All the water used for cooling and making process steam in this vast operation is supplied by six Worthington vertical turbine pumps. The pumps, with a capacity of over 6,000 gallons per minute, are used on cooling tower service.

Like other leading names in industry, Libbey-Owens-Ford has found that Worthington vertical turbine pumps can provide the most economical solution to many plant pumping needs. Refineries, chemical plants, pharmaceutical plants, manufacturing plants—all are turning to these modern pumps as a really dependable means of delivering water.

If you are faced with the problem of pumping hot water or volatile liquids, write for Bulletin W-450-B39 to Worthington Corporation, Vertical Turbine Pump Division, Harrison, N. J., and find out about the Worthington vertical turbine pumps for yourself. D-3.15

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THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB

CENTRIFUGAL • ROTARY • STEAM • POWER • VERTICAL TURBINE

CONSERVE GROUND WATER—IT IS A VALUABLE RESOURCE

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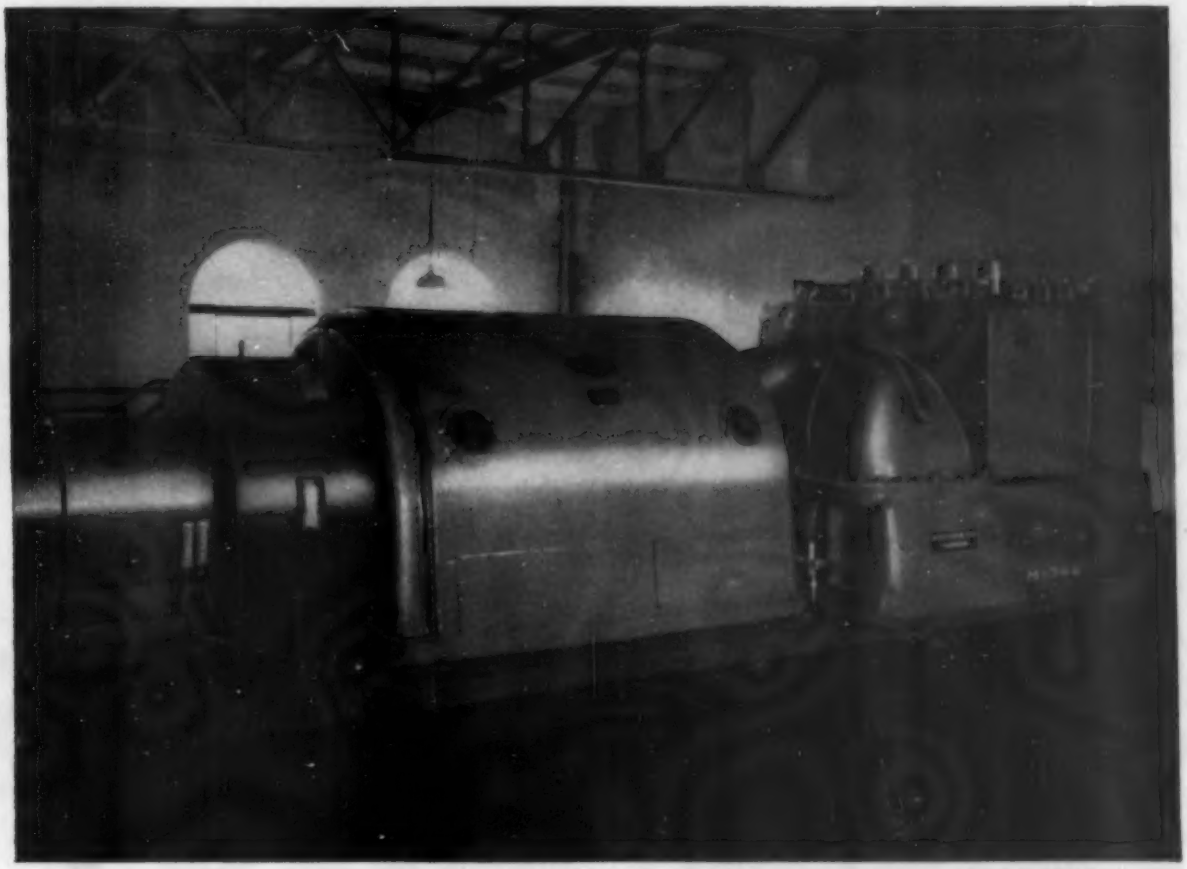


NEWEST OF THREE WORTHINGTON POWER UNITS installed in Detroit Lakes' Minn., municipal power plant is this 4000-kw extraction-condensing turbine-generator.

Production up–fuel costs down

That, in brief, is the happy story of the municipal power plant at Detroit Lakes, Minnesota.

Here's what happened. For the past few years Detroit Lakes has been modernizing its power plant. This program, highlighted by the installation of Detroit Lakes' third Worthington turbine-generator, has reduced fuel costs by more than 23% — despite a steady increase in plant output.

Other Worthington equipment also contributed to this fine performance record. The Worthington condenser, steam jet air ejector, air compressor, and cooling water, condensate and feedwater pumps all played their part in keeping production up — and costs down.

It's clear that this Worthington equipment has paid off for Detroit Lakes. Not so evident is the secure feeling the Detroit Lakes people get from knowing that every Worthington unit is designed, assembled and tested as a complete unit *before* shipment.

This undivided responsibility can mean dollars saved for you, too. Get the whole story from your nearest Worthington district office. Or write to Worthington Corporation, Steam Turbine Division, Section T.4.6, Wellsville, N.Y.

T.4.6

"See the Worthington Corporation Exhibit in New York City. A lively, informative display of product developments for industry, business and the home. Park Avenue and 41st Street."

WORTHINGTON

STEAM TURBINES

Single and Multi-Stage Turbines • Turbine-Generators • Deaerators • Boiler Feed Pumps • Surface Condensers

A GREAT TEAM IN STEAM

Circle 507 on Reply Card for more data

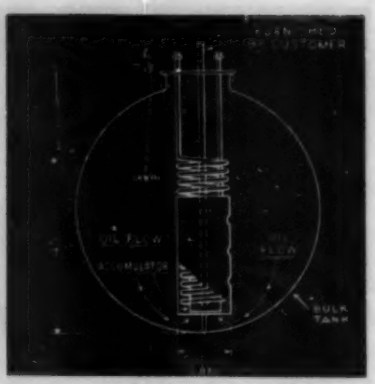
new equipment

—Starts on page 8

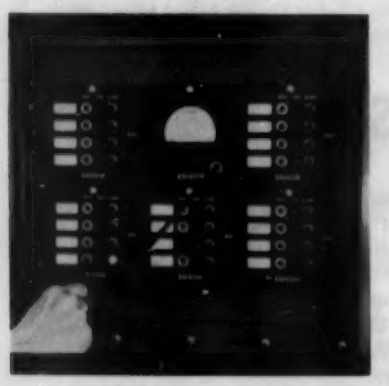
M16 FOR INITIAL pressures as high as 4000 psi and also reduced pressures from 2000 psi down to 0 psi in accurately controlled adjustable increments, Atlas Valve Co. is offering the Type "F" reducing and relief valve. This spring loaded, diaphragm operated, combination valve can reduce high pressure air, oil, or water and make these reductions down to a set point without shock. Variations in initial pressure have little effect on the reduced pressure. Valve is available in ⅛, ¼, ½, and ¾ in. sizes.

M17 FOR MARKING on almost any surface—glass, metal, paper, plastic, and cloth—the Tech-Pen is furnished with permanent ink that will withstand temperatures up to 500 C (with red resisting temperatures up to 1000 C). Palo Laboratory Supplies, Inc.

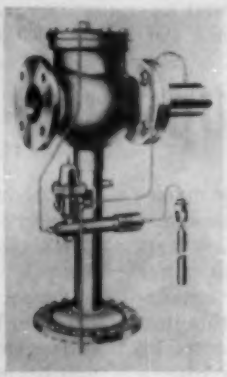
M19 WATER-COOLED air conditioning equipment pictured has been designed by Halstead & Mitchell Co. for installation in crowded basements reached by narrow stairs or on roof tops where the expense of a rigger for hoisting would be excessive. These "Take-Apart" Cooling Towers are shipped assembled, and are then separated into several sections by easy-to-get-at bolts. In a size range from 5 through 30 tons, the cooling towers retain all the important HM features. Drive shafts and fans are made of stainless steel, and housing is protected against corrosion.



M21 FOR PREHEATING of fuel oil in bulk tanks before the oil enters the suction line, Rempe Co. is introducing the Hot Spot, a preheater that can be easily installed through the manhole of a bulk tank. An all-steel shell and coil assembly, the preheater rests on the bottom of the bulk tank with inlet and outlet pipes for heat (steam or hot water) and suction line going through the manhole cover. The unit is made in two sizes, for 14½ in. manholes and for 16½ in. manholes and larger, and is custom built for your requirements. No cutting is necessary on the job.



M18 TEMPERATURE monitoring system—to be known as Omniguard, this new system is designed to protect a few or several hundred remotely scattered points from temperature excesses. According to the manufacturer, the Instrument Div., of Thomas A. Edison, Inc., its basic simplicity, building-block design, and low cost bring this type of system within reach of both large and small users. The system is complete whether four points are installed or four hundred points. The Omniguard monitors each point simultaneously without scanning so that no point is left unguarded.



M20 TO PREVENT the hunting, cycling or overheating that sometimes occurs with a temperature control alone, Klipfel Valves, Inc. has designed a single main valve, known as No. 1649, that gives both temperature and pressure control. Pressure range is 5 to 125 lb. and temperature adjustment range is 50 degrees F. Sizes 2 in. and over have semi-steel bodies; smaller sizes have bronze bodies. Stainless steel valve trim is used in sizes 4 in. and smaller, and larger sizes have bronze trim as standard but can be supplied with stainless. In operation, valve is set to meet maximum demand of system.

M22 DETECTOR which locates grounds on energized power lines without interfering with continuous production, the Brunt Faultfinder, prevents costly shutdowns. Known as the Universal Model #54, the instrument can be used on voltages of 120, 240, 480, or 450 ac or ungrounded dc. It transmits an audible signal over the faulted line until the point of fault is reached, where the signal dies out. Parr Manufacturing Corp. has designed the instrument for use in dark or inaccessible locations, and for tracing overhead or buried lines. Insulated extension pole makes ladder-climbing unnecessary.

BETZ • *A Great Name In Water Conditioning*

Meet your V.I.P.

The Betz Sales Engineer, a *Very Important Person?*

We think so.

With his experience and full knowledge of water conditioning, and with the facilities of the *entire* Betz Organization to assist him, he is ready to step in and recommend ways and means to achieve more efficient, economical plant operation through proper water conditioning.

It's his job to work shoulder to shoulder with you and your operating level personnel . . . assist in setting up correct systems of control . . . keep you fully abreast of the latest developments in Betz water conditioning technique . . . and a host of other services, from "trouble-shooting" to being a real part of your team.

Chances are, a Betz Sales Engineer can be the most important visitor you may receive today. Let him tell you how Betz *completely-integrated* water conditioning service can help you with your problem that's "different". You'll be glad you did.

W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa. In Canada: BETZ Laboratories Limited, Montreal 1.

BETZ

CONSULTANTS ON INDUSTRIAL WATER PROBLEMS

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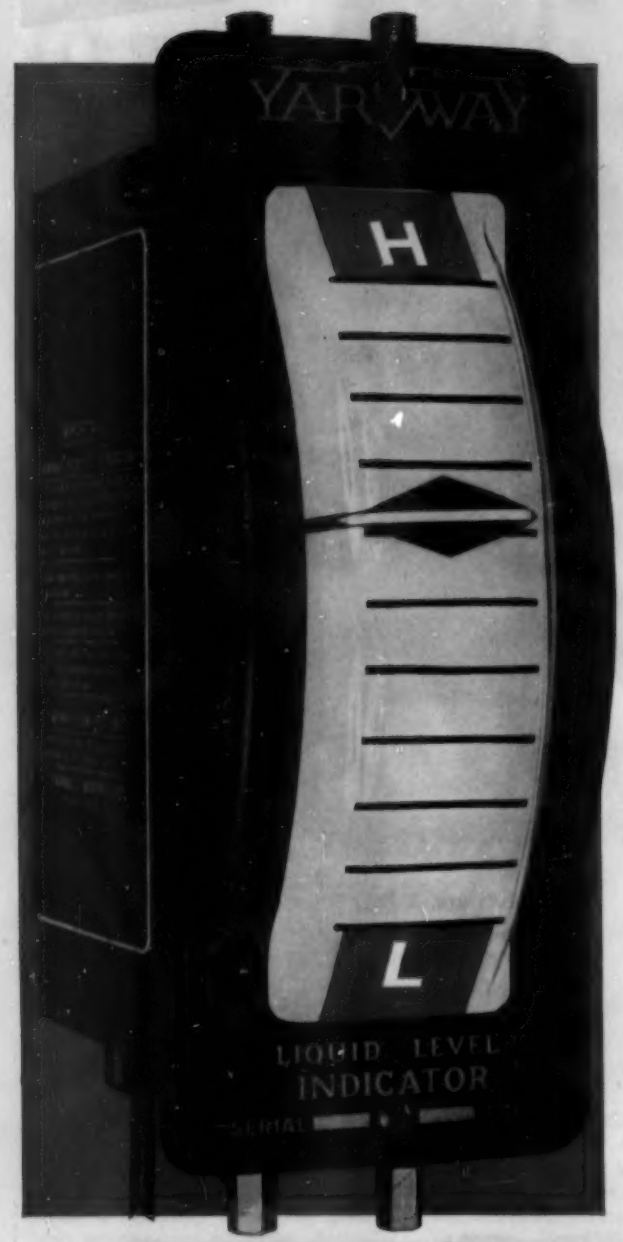
"this is



● Engineers tell us Yarway Remote Liquid Level Indicators are the most dependable boiler insurance they can have.

Instant . . . accurate . . . brilliant . . . continuous readings of boiler water level are seen on the panel or wherever you wish in your plant. You know the readings are right because they are controlled by the boiler water itself . . . by the pressure differential between a constant head of water and the varying head in the boiler drum. *Indicating mechanism is never under pressure.*

Yarway Indicators may be equipped with a Yarway Control Unit that operates Remote Hi-Lo-Alarm signal lights or horns. For a 24-hour record of boiler water levels, use the Yarway Hi-Lo-Graph Recorder.

On the boiler drum itself you'll want Yarway Water Gages . . . and these "bright as a star" gage readings can now be televised with a Yarway—RCA Television chain.

From drum to panel and at all remote locations, Yarway equipment gives you the safest boiler protection you can buy . . . proved beyond doubt in thousands of power plants.

Write for the specific bulletins you want.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

NEW! WIDER VISION!

Clear, brilliant readings from any angle, are possible with the new "wide vision" face on the Yarway Remote Liquid Level Indicator. Pointer is always visible, even at extreme high and low water levels.

The Yarway Indicator is manometric type with automatic temperature compensation, as approved for use under the ruling of A.S.M.E. Boiler Code Committee in Case #1155.

Described in Yarway Bulletin WG-1824.

YARWAY

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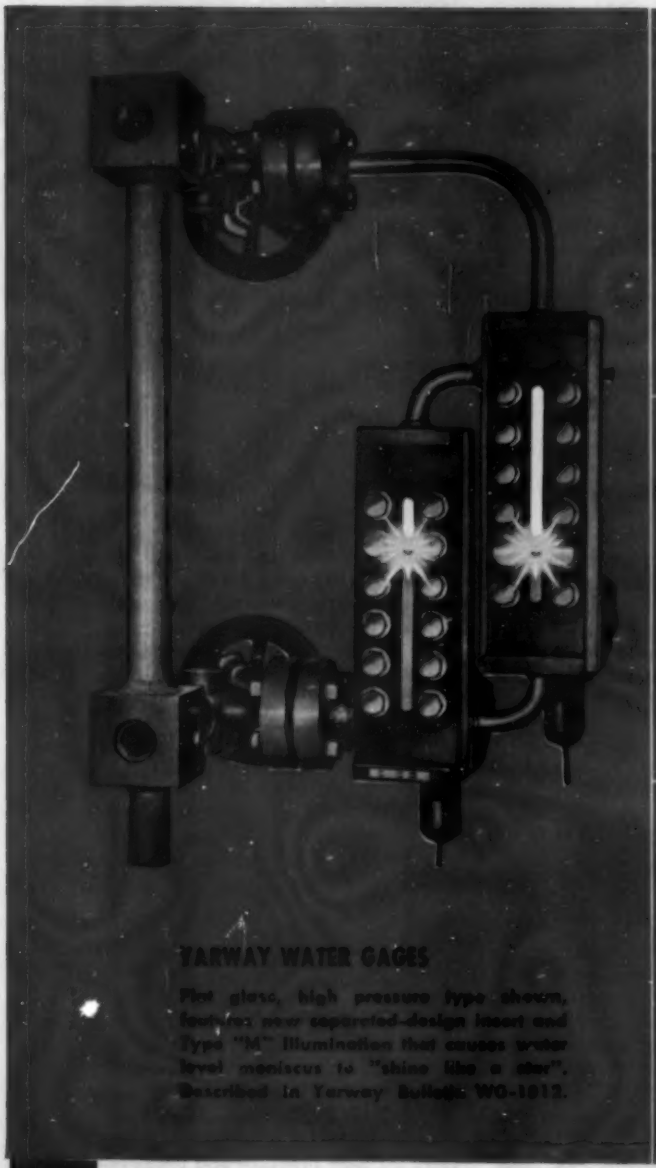
good boiler insurance!"



YARWAY WATER GAGES

Flat glass, high pressure type shown, features new separated-design insert and Type "M" illumination that causes water level meniscus to "shine like a star". Described in Yarway Bulletin WG-1812.

YARWAY REMOTE SIGNAL ALARMS

Lights or horns, operated by Control Unit on Yarway Indicator, give instant warning of any serious deviation from normal water level. Can be located anywhere in plant. Described in Yarway Bulletin WG-1834.

YARWAY HI-LO-GRAPH RECORDER

Gives a continuous 24-hour record of liquid levels. Actuating mechanism is common to Yarway Indicator. Used both for indicating and recording. Described in Yarway Bulletin WG-1820.

YARWAY TELEVISION

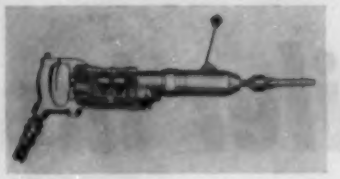
Simplified system consists of compact camera and panel-mounted monitor. Clear, bright image of water level gage anywhere in the plant.
Described in Yarway Bulletin WG-1813.

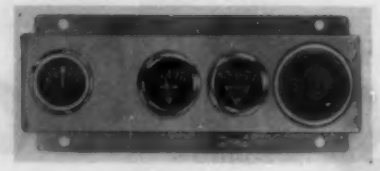
steam plant equipment

BLOW-OFF VALVES
WATER COLUMNS AND GAGES
LIQUID LEVEL INDICATORS
EXPANSION JOINTS
STEAM TRAPS
STRAINERS
SPRAY NOZZLES
DIGESTER VALVES

new equipment

—Starts on page 8





M23 THE ANSWER to small industrial pumping needs, the BJ Subette submersible pump announced by Byron Jackson Co. is a packaged unit for water requirements ranging for 30 to 260 gpm from wells 6 and 8 in. ID and larger, with motor sizes from 5 to 35 hp. The Pressurmatic non-mechanical oil pressurizing system incorporated in the pumps provides automatic sealing pressure to the oil in the motor without use of mechanical devices. BJ submersible motors furnished with the pump can be quickly and easily re-wound with standard materials and are oil filled.

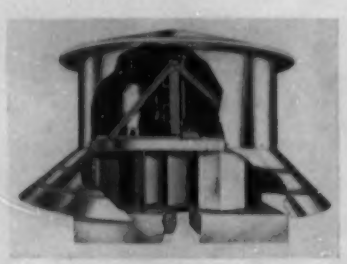
M26 REMOVING DAMAGED or faulty small tubes from condensers and heat exchangers can be done easily and quickly with the new Internal Tube Cutter, according to the manufacturer, The Airetool Mfg. Co. The cutter is inserted in the tube and quickly cuts the tube behind the tube sheet. Airetool tube removal tools are then used to knock out and remove the remaining portion of the tube in the header. The cutter is a double-action cutting tool with two cutters, and is also self-centering. It will cut steel and non-ferrous condenser tubes from ⅝ to 1 in. OD.

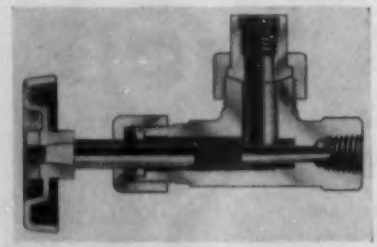
M29 THIS SAFETY gage panel will protect unattended or remote-controlled engines — such as on irrigation pumps, air compressors, sump pumps, and generator sets — from burned bearings, frozen pistons, or other costly failures. Minimum oil pressure or maximum engine temperature at which it is desired to shut off the engine is predetermined by the position of "stop" on the face of the gages. Manufactured by the Instrument Div., Stewart-Warner Corp., the panels are available for engines with battery or magneto ignition and also for diesel engines.

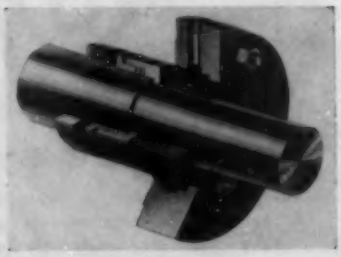
M24 TO ELIMINATE the disadvantages of a commutator and slip rings in d-c generators, International Rectifier Corp. is introducing the Rotating Selenium Rectifier. The unit uses six individual 5 in. dia selenium plates and is used to supply power to the field of a 30 kw diesel generator set. It will deliver 750 w at 30 v. Circuit design information is available.

M27 FOR DEHYDRATING and filtering compressed air, Hankison Corp. announces two new models of the Condensifilter, the M-30 and M-100. All sealing is with "O" rings, eliminating need for tools to dismantle units for service. Operating pressures are up to 200 psi. The M-30 is rated at 30 scfm and the M-100 at 100 scfm, both at a line pressure of 100 psig.

M30 SINGLE SPRING construction, more accurate valve seating, and lower over-all height are features of Schutte and Koerting Company's Spring Loaded Relief Valves. Cumbersome, unstable superstructures of conventional multiple valves of this type are eliminated. Guiding spindles at both top and bottom of valve disc permit use of valve in any position.



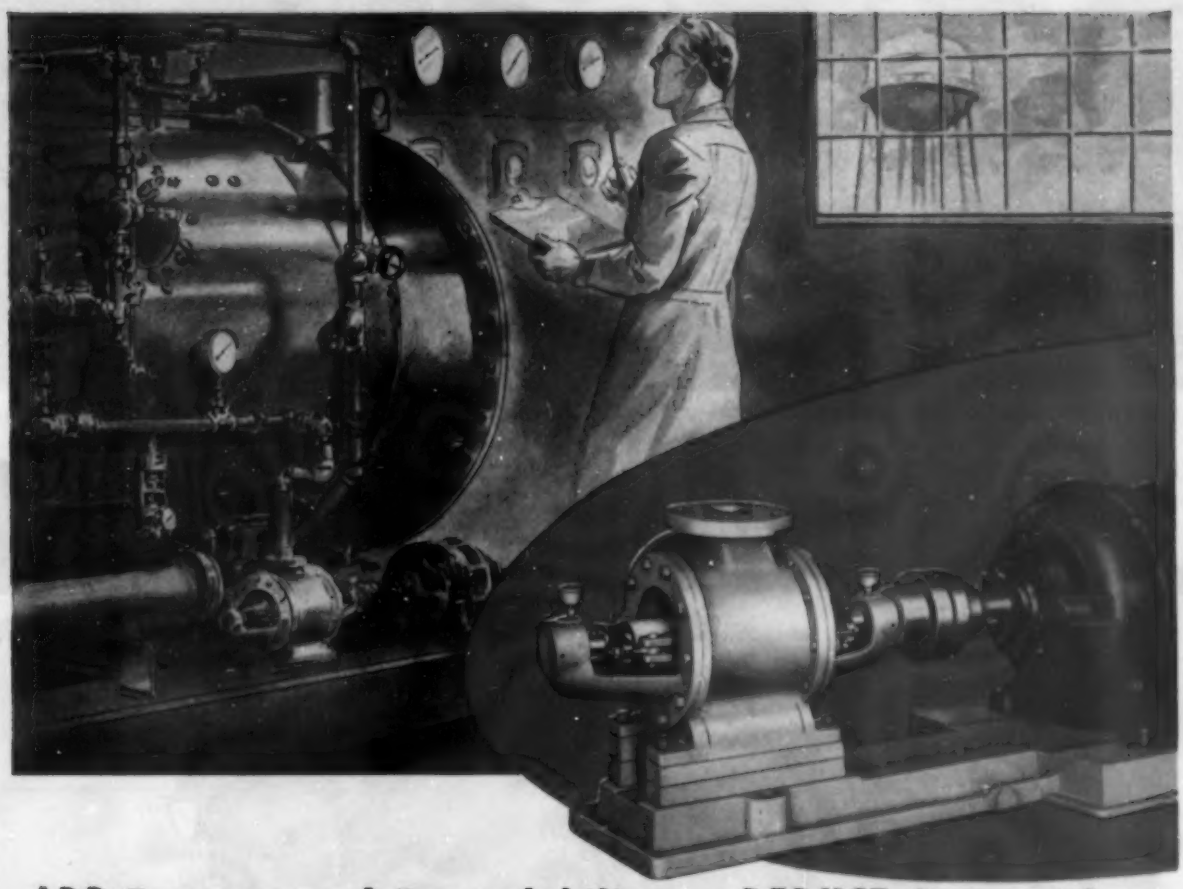




M25 NOISE LEVEL is kept to a minimum with Gyra-Flo Power Roof Exhauster, Type B, being introduced by Chicago Blower Corp. Available with either direct or V-belt drive, the air-flow design of the exhauster allows the lowest possible wheel tip speeds. Housing, motor, and fan wheel can be removed easily. Direct motor drive exhausters deliver from 830 to 2590 cfm in a range of sizes with static pressures from ⅛ to ¾ in.; V-belt drives deliver from 1420 to 29,750 cfm in fan sizes from 122 to 440 with static pressures of ⅛ to ¾ in.

M28 NEEDLE VALVE users experiencing difficulty with the common "bulk valve" will be interested in the complete new line of forged needle valves with universal outlets announced by Carpenter Valves Corp. Known as Bull-Dog needle valves, the units feature micrometer thread, stainless steel stems for fine metering and have bodies forged from brass, stainless steel, or carbon steel. The wide range of optional machining on outlets facilitate lower priced installations, since no extra charge is made for any optional machining.

M31 ROTARY mechanical seal, Type P. T. Inside Dura Seal-Balanced, has been designed specifically for high pressure and temperature operation. A development of the Durametallic Corp., the seal can be fabricated from metal alloys for handling all kinds of fluids except molten alkali metals and some fluorine compounds in the higher temperatures. It will take pressures from 50 to 600 psi and temperatures from –80 to 400 F. For mounting, a cut-down shaft or stub sleeve is required, and a packing space of ½ in. clearance or larger is needed.



ADD Economy and Dependability . . . *DEDUCT* Costs with—
MODERN PUMPING EQUIPMENT

DUDCO DIVISION
Hazel Park, Mich.
Dual-Vane Hydraulic Pumps, 3 to 120 gpm; Fluid Motors, 7 to 140 hp; 2000 psi operation. Piston-Type Pumps for 5000 psi.

HYDRECO DIVISION
Cleveland, Ohio
Gear-Type Hydraulic Pumps, 3 to 120 gpm; Fluid Motors, 3 to 52 hp; Cylinders; Control and Auxiliary Valves; 1500 psi.

WATERTOWN DIVISION
Watertown, N. Y.
Railroad air brake valves for freight and passenger equipment, STRATOPOWER Hydraulic Pumps for Aircraft, to 3000 psi.

KINNEY MANUFACTURING DIVISION
Boston, Mass.
Rotating Plunger and Heliquad Liquid Handling Pumps, to 3000 gpm. Vacuum Pumps, 0.2 micron, evacuate 1800 cfm.

AURORA PUMP DIVISION
Aurora, Ill.
Liquid Handling Pumps, Centrifugals, 4000 gpm, 500 ft. heads. Turbine-Types, 7000 gpm. Condensate Return Units.

From the sump in the basement to the water tower above the plant, your Liquid Handling Equipment is moving *dollars* as well as water. Are these dollars profit or loss? That is the question!

The Aurora Pump and Kinney Manufacturing Divisions of The New York Air Brake Company provide industry with the Pumps to modernize all Liquid Handling installations. For plant water systems; for sump, boiler feed, condensate return, refrigeration, air conditioning and drainage . . . Aurora and Apco Turbine and Centrifugal Pumps bring important economies to every problem of water transfer. These pumps cover a broad range of capacities, pressures, configurations and choice of drives. In many cases, they perform special services in the processing of beverages, chemicals, acids and the transfer of gasoline and oil.

Kinney Pumps, in Rotating Plunger and Heliquad Gear types, have a well established reputation of being able to *"move anything that will flow through a pipe"*. They are the economical answer to the processing of sludges, slurries, asphalt, bunker fuel, waxes, molasses and other viscous or semi-solid substances.

For Vacuum Processing, the new developments in Kinney High Vacuum Pumps afford added opportunities for savings in production costs.

A fourth, and equally interesting, opportunity to increase productivity and reduce costs is found in the Fluid Power facilities of the Dudco, Hydreco and Watertown Divisions of The New York Air Brake Company.

Look to YOUR Pumps! They represent one of the most important areas for savings in the modern plant.

Literature fully describing these modern Liquid Handling, Vacuum Processing and Fluid Power pumps, as well as Air Brake's exceptional facilities for precision sub-contract work, is yours for the asking. Write for it today!

THE NEW YORK AIR BRAKE COMPANY

230 PARK AVENUE • NEW YORK 17, N. Y.

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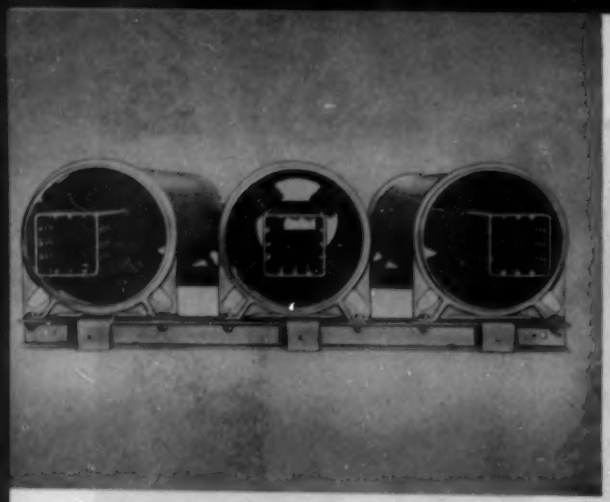
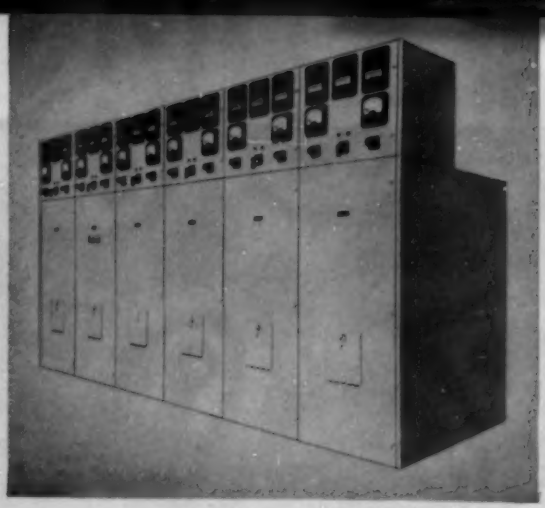


METAL-ENCLOSED BUS STRUCTURES

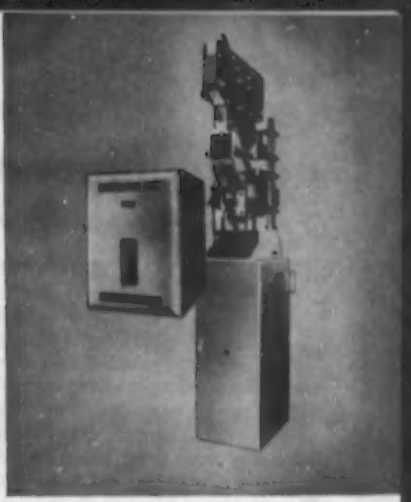


METAL-CLAD SWITCHGEAR

Put I-T-E

UNIT SUBSTATIONS

LOW-VOLTAGE SWITCHGEAR



LARGE AIR CIRCUIT BREAKERS

in your power plans...

for Dependability, Safety, and Over-all Economy

A complete line of Quality Switchgear Equipment

From generation to utilization, I-T-E quality equipment serves every industrial and commercial application. Whether your plans include bus structures, metal-clad or low-voltage switchgear, unit substations, or individual circuit breakers—you are assured of I-T-E's many *extra-service* benefits, which include:

1. selection and application of equipment
2. preparation of specifications
3. coordination of all job requirements

Power is fundamental in any new plant construction or expansion. Power distribution systems must be planned to assure maximum dependability of service, safety for personnel and equipment, and *over-all* economy—from initial planning . . . through the life of the equipment.

Furthermore, it is important to plan power systems with an eye to the future. They should be adaptable to changing plant requirements for many years ahead.

For these reasons, it pays to include I-T-E quality products in your power plans. For over 65 years I-T-E has set the standard for the industry—through engineering skill, design refinement, and introduction of new ideas and thinking.

For details, contact the I-T-E field office nearest you. Look in your classified telephone directory under "Electrical Equipment."

THE SYMBOL OF QUALITY SWITCHGEAR

I-T-E CIRCUIT BREAKER COMPANY

19TH AND HAMILTON STS. • PHILADELPHIA 30, PA.

SWITCHGEAR PRODUCTS

Circle 511 on Reply Card for more data

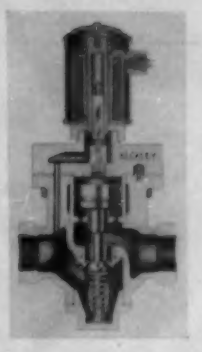
new equipment

—Starts on page 8

M32 MULTI-ZONE air conditioning unit maintains an even, comfortable temperature in various zones regardless of variations in building construction, changes in occupancy, wind, or solar exposure, according to the manufacturer, Westinghouse Electric Corp., Sturtevant Div. The unit supplies individual temperature and humidity requirements of as many as 12 zones in a building and is available in seven sizes ranging from 1665 to 21,000 cu ft per min. Air quantities and temperatures are regulated by positioning sets of interconnected hot and cold air dampers.

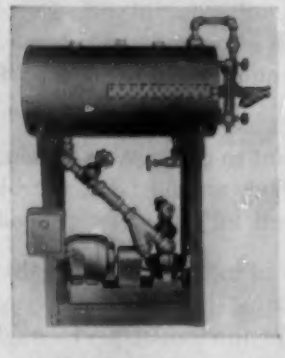
TO GET MORE INFORMATION

Circle "key" numbers on Reply Card between pages 34/35 & 90/91. Your requests will be handled promptly.



M34 PILOT-OPERATED solenoid valves, developed by O. C. Keckley Co., are designed for steam service at pressures to 250 lb or air, water, oil, and gas service to 600 lb. Sizes are ½ through 6 in. Valve bodies are bronze or semisteel; pilot valve, main valve, and seat are stainless steel. All wearing parts of pilot valve and main valve are readily renewable. The main valve body and parts are identical to and interchangeable with those of standard Keckley pressure and temperature regulators. Solenoid coils are glass insulated, heavy duty, moisture-proof type for high temperature and pressure service.

M36 FOR USE wherever immersion thermocouples are impractical or otherwise undesirable, Conax Corp. is introducing the Adjustable Pipe Clamp Thermocouple for reading outside pipe temperatures. Complete clamp assembly is stainless steel with high quality steel spring protecting the thermocouple terminal in the clamp. Thermocouples are available in Copper-Constantan for low temperatures or Iron-Constantan up to 1000 F. Sizes are for pipe sizes from ⅜ to 4 in. ips. These thermocouples are also useful for taking readings on alloy, plastic, or glass pipes not easily entered with standard thermometers.



M33 BOILER FEED combination system, incorporating a preheater that operates on steam from the boiler, automatically maintains boiler feed water between 190 and 200 F, according to the manufacturer, Cyclotherm Div., United States Radiator Corp. Tank sizes range from 30 to 540 gal. The units will supply from 280 to 2800 gal of pre-heated water every hour and can be used in conjunction with the Cyclotherm or other steam boilers. The preheater is said to lengthen boiler life by eliminating stresses caused by low temperature feedwater entering the already heated boiler shell and by reducing the amount of boiler scale that is formed.

M35 A DIGITAL supervisory remote control system designed for both remote measurement and for such control functions as remote shaft positioning, on-off switching, and proportional control has been introduced by Pacific Div., Bendix Aviation Corp. Known as the Electro-Span, the system is applicable for remote operation of unattended pipe line pumping stations, electrical substations, or other such installations. It can be used in conjunction with any electrical transmission medium including telegraph circuits, telephone line, VHF radio, or microwave links. The various units are plug-in design, allowing system flexibility in size and application.

M37 AIR POLLUTION from improperly burned fuel can now be measured with the MSA Smokescope, developed by Mine Safety Appliances Co. Need for such an instrument arose from difficulties with the old method which employed the "smoke chart" in which the observer set up a chart 50 feet from the check point and compared shadings on the chart to the color of the smoke issuing from the stack or chimney. With the Smokescope the observer views a standard reference disk, shaded to correspond with degrees of smoke density, against the background of a smoke plume. Design also eliminates possible interference of ambient light.

Get this FREE Water Softener Check-up!

Find out just what kind of job your zeolite water softener is doing

Never before has such a comprehensive zeolite water softener check-up service been offered—and without charge or obligation. Regardless of the age or make of your water softener equipment, you can have a thorough, technical SECA report (Softener Efficiency Cost Analysis) prepared by an Elgin-Refinite Engineer. It will be valuable now and for future planning.

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ELGIN-REFINITE PRODUCTS INCLUDE SOFTENERS OF ALL TYPES, DEIONIZERS, DEALKALIZERS, DEAERATING HEATERS, FILTERS, CHEMICAL TREATMENT, COMPLETE SYSTEMS.

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I am interested in having a SECA Report (Softener Efficiency Cost Analysis) without cost or obligation.

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STREET AND NUMBER_____

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Mail to: Elgin-Refinite, Division of Elgin Softener Corporation, 138 N. Grove Ave., Elgin, Ill.

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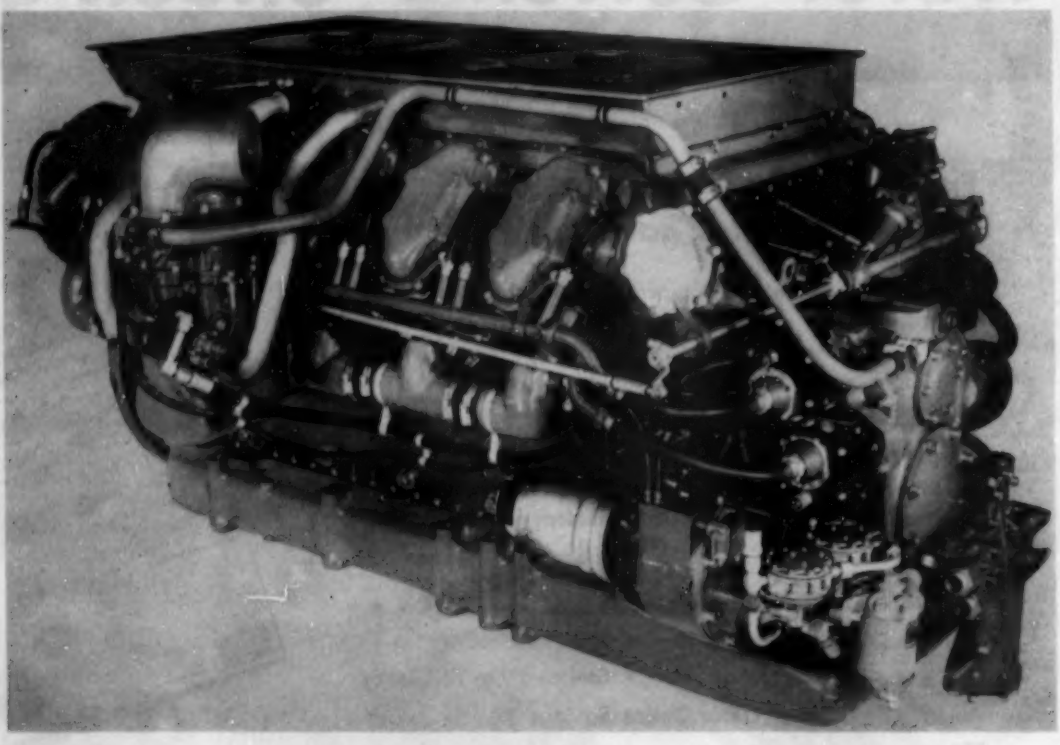
New Army Air-Cooled Engine Now Available to Industry



Continental Motors Corporation's 810 h.p. air-cooled engine pictured above, built for U. S. Army's famed General Patton tank, is one of a wide range of engines now available for heavy-duty commercial and industrial uses . . . The electrical wiring ignition harness, manufactured by National Electric, is a high voltage, radio-shielded system — rugged enough for combat — resistant to extremes of heat and cold — designed and built to operate under the most adverse conditions . . . National Electric also makes fine quality production harnesses for peacetime uses such as Automatic Clothes Washers, Dryers, Dishwashers and other home appliances . . . whatever your product — National Electric offers you more than a quarter century of experience in designing and producing fine electrical harnesses.

National Electric Manufacturing Company

High voltage ignition harnesses
Automotive chassis wiring harnesses
Home appliance wiring harnesses
Jet engine ignition harnesses
Switchboard panels
Control panels
Electrical timing mechanisms
Electrical temperature indicators
Automatic relay and switching devices

Electro-mechanical assemblies — manufactured to customers specifications

Niles, Michigan

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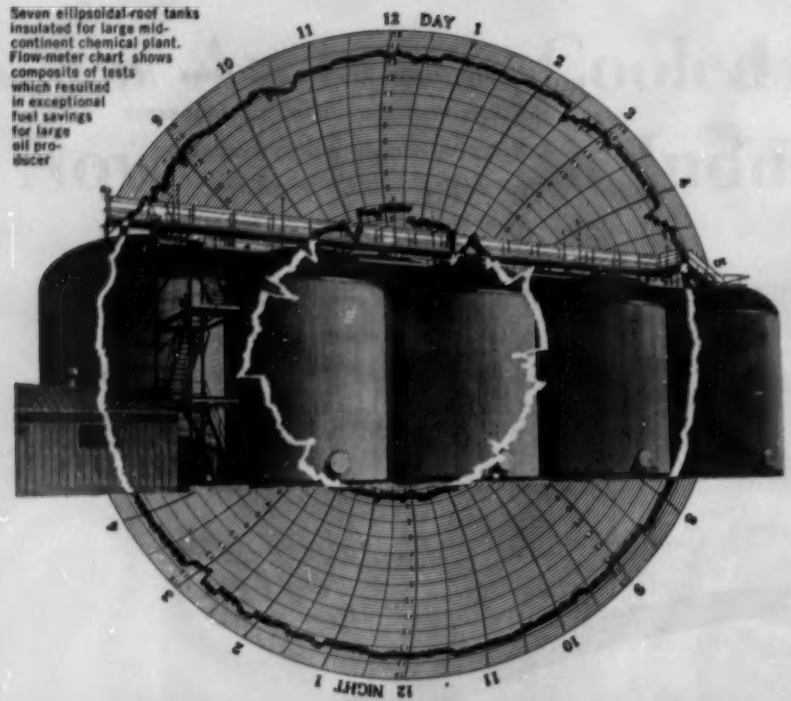


Seven ellipsoidal-roof tanks insulated for large mid-continent chemical plant. Flow-meter chart shows composite of tests which resulted in exceptional fuel savings for large oil producer

"FUEL SAVINGS TRULY AMAZING"

says top executive recommending new tank insulation method

PAYS OUT COSTS IN 4 TO 18 MONTHS

We quote from a letter one big oil company wrote another about the Nicholson & Galloway 3-stage Tank Insulation Method:

"We have had seven of our larger asphalt storage tanks insulated by their method of aluminum cladding... over a period of two years. The results in fuel savings have been truly amazing and far beyond our Engineering Department's expectations. The work has been carefully supervised and handled and we can recommend this firm and their methods most highly to you."

For details on cost of insulating your tank or vessel send for Pamphlet I.

Stage 1 Tank or vessel surfaces are divided into areas bounded vertically by channel sections

Stage 2 Insulation of any specification or thickness is snugly installed within these areas

Stage 3 .024 Corrugated Aluminum Sheathing, Asbestos Transite, Monel or Stainless Steel then covers and protects insulation for life of tank.

Conventional insulation shreds and falls loose when weather - proofing fails and metal bands expand.

Three asphalt tanks 50-foot diameter 48-foot high insulated for large southwestern oil refinery.

TANK INSULATORS INC
420-428 EAST 110TH STREET
NEW YORK 29, N.Y.

Phone ENright 9-5004

Circle 514 on Reply Card for more data

new equipment

—Starts on page 8

M38 ANY STEEL reinforced building material can be drilled to a depth of 18 in. with the masonary hole cutting machine announced by Molco Drilling Machines, Inc. Portable, high speed, and light weight, the machine uses a self-sharpening diamond drilling bit to cut holes ½ to 10 in. in dia through hard aggregate and steel reinforcing bars without loss of drilling speed. It is available in either one or two hp models.

M39 IT IS NOT necessary to open any pipe joints to install this pipe surface thermometer being introduced by Pacific Transducer Corp. The thermometer fastens to the pipe by means of a spring clip without the use of any tools and can be used on pipes and tubes from ½ to 2 in. Accuracy is ±2 F over the entire range of the thermometer which comes in two ranges, from —50 to 250 F and from 70 to 370 F.

Two Terry Turbines equipped with "trouble eliminators"

Because these turbines have solid wheels, they can take a lot of abuse, without complaint. Here's why:

1. The wheel has no separate parts to become loose or work out. It is a single forging, in which a series of semi-circular buckets is milled.

2. Blade wear is of little consequence because the power-producing action of the steam takes place on the curved surfaces at the back of the buckets. Wear does not materially affect horsepower or efficiency.

3. The blades cannot foul. There is a one inch clearance on either side of the wheel and, in addition, the blades are double rim protected. There is no need for close axial blade clearance, because the steam enters the buckets in a direction at right angles to the shaft.

For complete details of these *work horses of industry*, send for a copy of bulletin S-116. No cost or obligation.

THE TERRY STEAM TURBINE CO.

TERRY SQUARE, HARTFORD 1, CONN.

TERRY

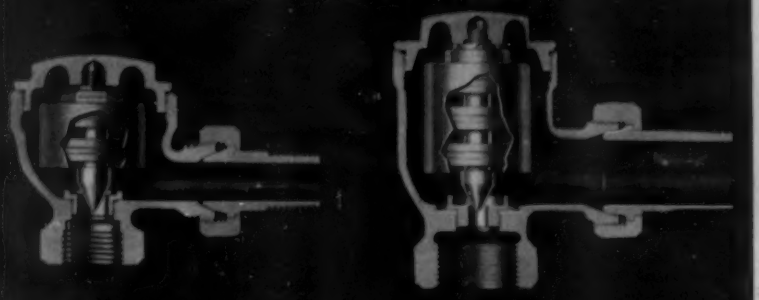
TT-1199

Circle 515 on Reply Card for more data

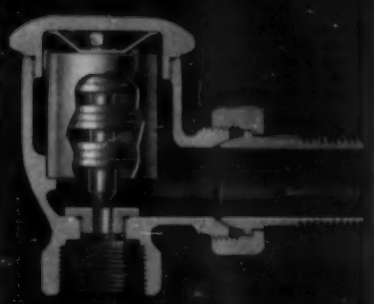
HOFFMAN STEAM TRAPS

FOR LOW, MEDIUM and HIGH PRESSURES

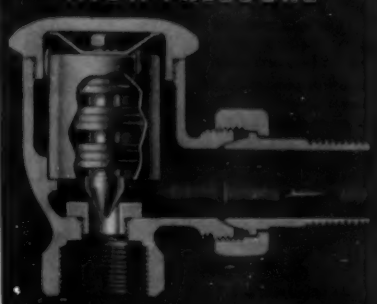
LOW PRESSURE TRAPS



MEDIUM PRESSURE



HIGH PRESSURE



FREE CATALOG

REPAIR PARTS

Here is your quick accurate guide to selection of parts needed for the profitable repair or replacement of Hoffman Thermostatic Traps. Includes listing of parts for discontinued series. Write for your free copy today.

Hoffman offers a complete line of Low, Medium and High Pressure Thermostatic Traps with uniform guarantee of quality and precision workmanship. A full range of sizes and capacities assures you the correct trap for service with radiation, dryers, sterilizers, mangles, cookers and similar uses. Body, cap, nut and tail piece are of high quality brass. Other features of design contribute to long life.

STEAM

Circle 516 on Reply Card for more data

new equipment

—Starts on page 8

M40 THE ANSWER to your plant's waste disposal problem may be this portable incinerator available in sizes to handle up to 450 lbs of waste per hour. Basic design is suited to the incineration of average dry waste, and modifications can be made for disposal of pathological waste, garbage, and other wet refuse. Literature is available. Plibrico Co.

M41 ONLY ONE MAN is needed to operate a new, lightweight condenser tube cleaner announced by the Airetool Mfg. Co. The unit weighs only 11 lbs but will clean completely plugged tubes up to 1 in. I. D. and smaller. The cleaner has a built-in flushing system with a quick shut-off valve for water feed and a muffler to reduce exhaust noises to a minimum.

M42 FOR ALL your medium duty cleaning applications Livingstone Engineering Co. announces the Speedylectric Hydrasteam 180 in both stationary and portable models.

This simple idea saves money in V-Belt Costs

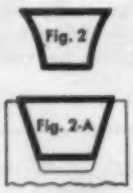
You can prove it in two minutes!

To prove how the CONCAVE SIDES of GATES VULCO ROPES *save money*, just make this simple test—

Bend *any* V-Belt that has *straight sides* (Fig. 1) and—as the belt bends—*feel* the sides *bulge out* (Fig. 1-A). This out-bulge concentrates the wear at the points shown by arrows—and this naturally shortens the life of a *straight-sided* belt!

Now bend a Gates Vulco Rope with CONCAVE SIDES (Fig. 2)

(U. S. PAT. 1813609)



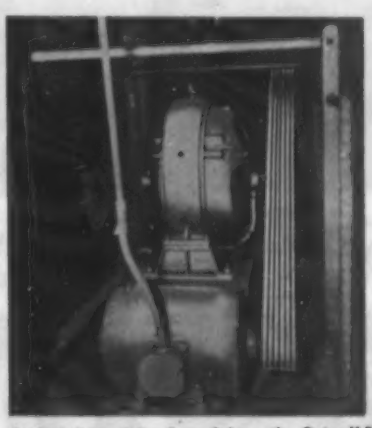
You find that the CONCAVE SIDES *fill out* and become perfectly straight. They thus press *evenly* against the V-pulley. All wear is distributed *uniformly* across the *full width* of the GATES VULCO ROPE—and this means *longer* belt *life* and *lower* belt *cost* for you!

When you buy V-Belts, be sure to get the V-Belt with the CONCAVE SIDES—the GATES VULCO ROPE!

VULCO ROPE DRIVES

THE GATES RUBBER COMPANY
DENVER, U.S.A.

Gates Engineering Offices and Jobber Stocks are located in all industrial centers of the United States and Canada, and in 70 other countries throughout the world.



Typical Gates Vulco Rope Drive—the Gates V-Belts are built with Concave Sides to insure longer belt wear.

CS-545

Circle 517 on Reply Card for more data

IN AIR AND HYDRAULIC CYLINDERS DARCOVA PUMCUPS PERFORM MORE EFFICIENTLY AT LOWER COST AND LAST LONGER!

Precision-built and texture-engineered for practically all services, Darcova Pumcups outlast most other packings at least 3 to 1. Fluid slippage is virtually eliminated, assuring *continuous* high efficiency. Far less maintenance! Lower operating costs! Send today for a free bulletin packed with helpful data and proof.

DARCOVA
THE ORIGINAL COMPOSITION CUP

DARLING VALVE & MANUFACTURING CO.
WILLIAMSPORT 9, PA.

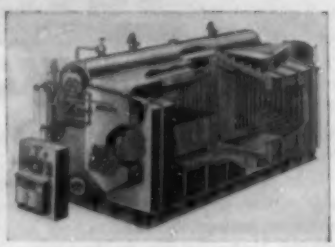
PUMCUPS

Circle 518 on Reply Card for more data

new equipment

—Starts on page 8

The built-in Sellers hydraulic unit provides a solid jet of superheated water and detergent at sufficient pressure to remove grease deposits and soil encrustrations that defy other cleaning methods. The unit provides pin-point cleaning under fingertip control of the operator and is available for operation on 220, 440, or 550 v, two or three phase, 25 or 60 cycle power supply.



M43 THE TYPE D Superior steam generator introduced by Superior Combustion Industries, Inc. is completely assembled and fire tested at the factory before shipment. Designed for firing with gas, a variety of fuel oils, or both, the water tube units have continuous steam capacities up to 40,000 lb per hr and may be combined in batteries for any required total capacity. The rear-mounted forced draft fan provides an air-cooled furnace roof with the firing front left clear for easy access by operating personnel.

TO GET MORE INFORMATION

Circle "key" numbers on Reply Card between pages 34/35 & 90/91. Your requests will be handled promptly.

M44 FEATURES designed to minimize maintenance difficulties are incorporated in a new line of cast semisteel Y-type pipe strainers developed by Armstrong Machine Works. For use in steam, air, water, oil, and gas lines at pressures to 250 lbs, the strainers are available in eight sizes from ½ through 2 in. Type 430 stainless steel screens are standard. Literature is available.

ELECTRICAL CONDUIT

PERMANENT
EASILY INSTALLED
LIQUID-TIGHT
FLEXIBLE
APPROVED

SEALTITE (TYPE U.A.) is approved by Underwriters' Laboratories, Inc. for use where exposed to moisture or mineral oils (up to 60C). See N.E. Code, Art. 351.

SEALTITE
ELECTRICAL CONDUIT PROTECTS WIRING

against oil, grease, water, dirt, chemicals, corrosive fumes, salt spray, weather

SEALTITE* is a flexible *and* liquid-tight electrical conduit. It gives maximum protection to your wiring when it must connect moving parts, absorb vibration, follow machine contours, flex into U-bends, be easily maintained or be safeguarded between misaligned ports.

It is being used successfully in wet locations, in tunnels, power plants, steel mills, canneries, chemical industries and in many outdoor applications. SEALTITE comes in two types:

TYPE U.A.—UL-approved. Made with flexible galvanized steel core, positive ground and tough outer cover.

NOM. I.D. (Inches)	INSIDE DIA. (Inches) Min.	Max.	OUTSIDE DIA. (Inches) Min.	Max.	APPROX. INSIDE BEND DIA. (Inches)	EST. WEIGHT per hundred ft. (Pounds)
⅜	.484	.504	.690	.710	8	30.0
½	.622	.642	.820	.840	10	36.6
¾	.820	.840	1.030	1.050	13	48.2
1	1.041	1.066	1.290	1.315	18	67.7
1¼	1.380	1.410	1.630	1.660	21	116.5

TYPE E.F.†(Extra Flexible)—for machine tools and industrial equipment. (Meets standards set by J.I.C.) †Pat. Applied For

NOM. I.D. (Inches)	INSIDE DIA. (Inches) Min.	Max.	OUTSIDE DIA. (Inches) Min.	Max.	APPROX. INSIDE BEND DIA. (Inches)	EST. WEIGHT per hundred ft. (Pounds)
⅜	.485	.505	.690	.710	5	24.3
½	.620	.640	.820	.840	6	29.0
¾	.815	.835	1.030	1.050	9	38.2
1	1.025	1.055	1.290	1.315	10	65.0
1¼	1.365	1.395	1.630	1.660	13	84.4
1½	1.575	1.605	1.870	1.900	15	122.0
2	2.020	2.055	2.335	2.375	17	156.0
2½	2.480	2.515	2.840	2.875	20	205.0
3	3.076	3.110	3.460	3.500	27	290.0
4	4.000	4.050	4.460	4.500	34	430.0

Commercial tolerances apply on above figures.

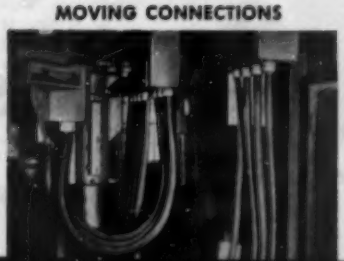
ELECTRICAL WHOLESALERS stock both types. Buy it in long random lengths as shown; then cut without waste. Or ask your wholesaler to cut the length you need. Liquid-tight connectors are available from wholesalers' stocks. Write for Bulletin UA-531. *The American Brass Company, American Metal Hose Branch, Waterbury 20, Conn.*

*Trade Mark 54175

SEALTITE flexible, liquid-tight electrical conduit an **ANACONDA®** product

FOR WET SPOTS

MOVING CONNECTIONS



OUTDOORS

MISALIGNMENT

save from the start

replace your castings with flame cut parts

SHAPES CUT FROM PLATE — UP TO 16" THICK

If your casting has two flat sides and a perpendicular edge in almost any shape, it can be cut out of steel plate by FOSTER. Flame cut parts are better than castings in some applications because they are lighter in weight, easier to machine, have greater strength, and cost less money. Shown above is a group of National Cylinder Gas flame cutting machines in operation. By using such modern equipment, FOSTER is able to mass produce shape cut parts at reasonable prices. Sometimes a casting can be replaced by a weldment. Two or more parts cut from steel plate and welded together may often present a considerable saving over a similar casting. Any reasonable shape from 1" square to 8 square feet can be cut by FOSTER — to your exact specifications.

Detroit Representative
FRANK LYONS & SONS
2980 W. DAVISON AVE.
DETROIT 6, MICHIGAN

THE FOSTER COMPANY • Stevensville, Michigan

THE **foster** COMPANY

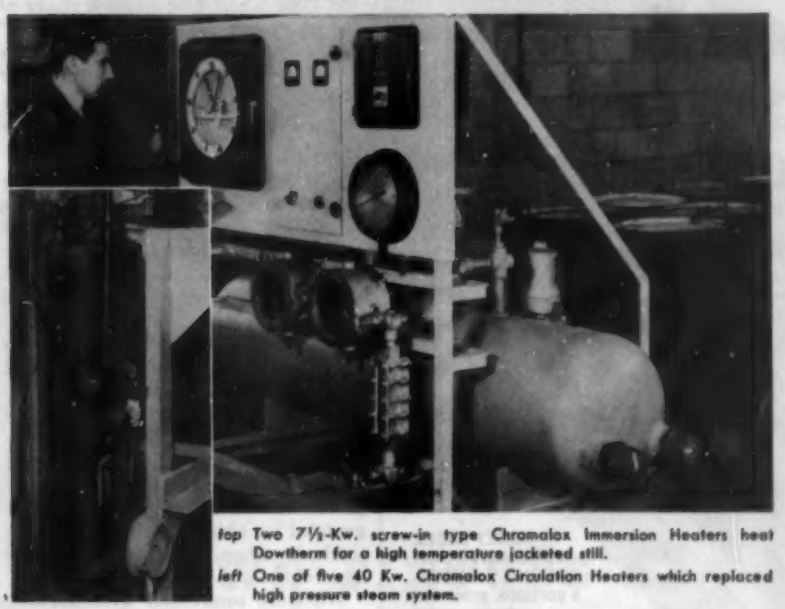
Circle 520 on Reply Card for more data

CHROMALOX Production TIPS

PROFITABLE IDEAS FOR BETTER PRODUCTION with ELECTRIC HEAT

HOW ELECTRIC HEAT REPLACED A STEAM SYSTEM

AND RESULTED IN INCREASED PRODUCTION AND CLOSER CONTROL



top Two 7½-Kw. screw-in type Chromalox Immersion Heaters heat Dowtherm for a high temperature jacketed still.

left One of five 40 Kw. Chromalox Circulation Heaters which replaced high pressure steam system.

After an evaluation of heat sources for new equipment and replacement required for increased production, a New York chemical manufacturer specified Chromalox Electric Heaters.

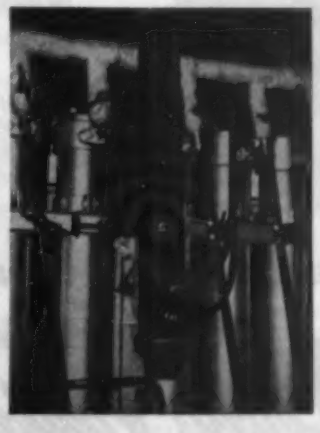
Chromalox Electric Immersion Heaters were installed for heating Dowtherm, used as a heat transfer medium in high-temperature jacketed stills. No expensive boiler system or piping was needed. In chlorinating reactor vessels, Chromalox Circulation Heaters replaced a high pressure steam system when increased production, closer control and higher operating temperatures were needed.

The company also equipped its new research building with Chromalox Heaters for *all* heating needs. Among advantages gained with Chromalox Electric Heat were: 1—Instant readiness for production; 2—exact temperatures; 3—accurate control; 4—around-the-clock reliability.

REACTIVATING ALUMINA WITH ELECTRIC HEAT

A quick and easy way to automatically reactivate alumina used to dry oxygen is to connect the drying system to Chromalox Circulation Heaters. Nitrogen heated by the heaters passes through the moisture laden alumina and dries it for reuse. One company installed a 460 V, 3-phase, 9-Kw thermostatically controlled Chromalox Circulation Heater for the job. At 500° F. the heater cuts off automatically if nitrogen flow is restricted or stopped.

Chromalox Circulation Heaters, with element sheaths and internal construction of suitable metals, are used widely for heating air and other gases, for heating oil, superheating steam and heating water and other liquids.

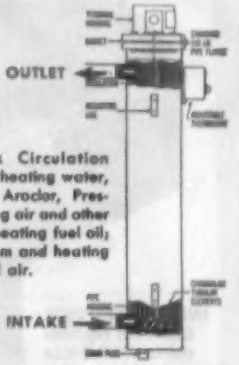


HOW TO GET MORE BTUs FROM BUNKER C OIL

Here's a tip that will save you money on oil-fired processing equipment. Heavier, less expensive fuel oils perform just as well as lighter, more costly grades if they are first preheated for thinning and consequent vaporization with Chromalox Circulation Heaters. These automatic heaters are simple to hook up, give real economy in steam boilers, furnaces, kilns and other equipment using fuel oil.

CHROMALOX ELECTRIC CIRCULATION HEATERS

The quick, comparatively low-cost solution to many industrial heating problems.



Chromalox Circulation heaters for heating water, Dowtherm, Aroclor, Prestone; heating air and other gases; preheating fuel oil; drying steam and heating compressed air.

Industrial Division
EDWIN L. WIEGAND COMPANY
7520 Thomas Blvd., Pittsburgh 8, Pa.

My heating problem is _____

_____

_____

☐ Have your Application Engineer get in touch with me.
☐ Send me a complete Chromalox Catalog.
☐ Put me on your mailing list for helpful Chromalox literature.

Name _____
Company _____
Street _____
City _____ Zone ___ State _____

Circle 521 on Reply Card for more data

It's easier···
with Heinemann Service Equipment
···designed for the job

SAFELET has receptacle for power tools or appliances. Built-in circuit breaker interrupts short circuits and dangerous overloads, prevents damage to equipment that's plugged-in. For use in the home workshop, on the test bench or production line. Write for Bulletin 1010

RECEPTACLE TYPE OUTDOOR SERVICE UNIT is a portable, protected power outlet for temporary plug-in service. Easily moved from job to job. Write for Bulletin 2016.

INDOOR SERVICE CENTER replaces old-fashioned fuse boxes, combines either two, four or eight circuit breakers in a handsomely styled unit for mounting anywhere in the home or commercial property. In office building installation shown, each office has its own Service Center so that power interruptions are isolated. Heinemann circuit breakers assure immediate, simple restoration of service. Write for Bulletin 1002.

HEINEMANN ELECTRIC COMPANY
140 Plum Street
Trenton 2, New Jersey

HEINEMANN *Circuit breakers*

Circle 522 on Reply Card for more data

letters

. . . from readers

Fire Away

Gentlemen:

On page 58 of your November issue is an article on overfire air by W. C. Gaumer. Very good.

Do you know of some one here in the East who could make a study of my plant and supply such a system?

C. Joseph Parker
Engineer
Rice & Company
Pittsfield, Mass.

Dear Sir:

We were very interested in your article on "Overfire Air" in (Nov., p. 58) INDUSTRY AND POWER. As you know, this organization and Battelle Memorial Institute have done a good deal of work on overfire jets and spreader stokers.

We were particularly interested in the chart relating cinder loading and combustion rate, and Table 23.

As the cost of dust-loading tests is high, few data are available for industrial plants where the cost of such elaborate testing is not usually justified. We are therefore always grateful for obtaining new data, particularly when they are exhaustive and reliable.

We were impressed with the variety of applications of overfire jets you describe in your article. We noted that most of your jets are shown near the fire or pointing towards the fire. This agrees with our experience which indicates that the closer the jets are to the fire beds, the more effective they are in eliminating smoke.

Charles H. Marks
Development Engineer
Bituminous Coal Research, Inc.
Columbus, Ohio

RF Interference

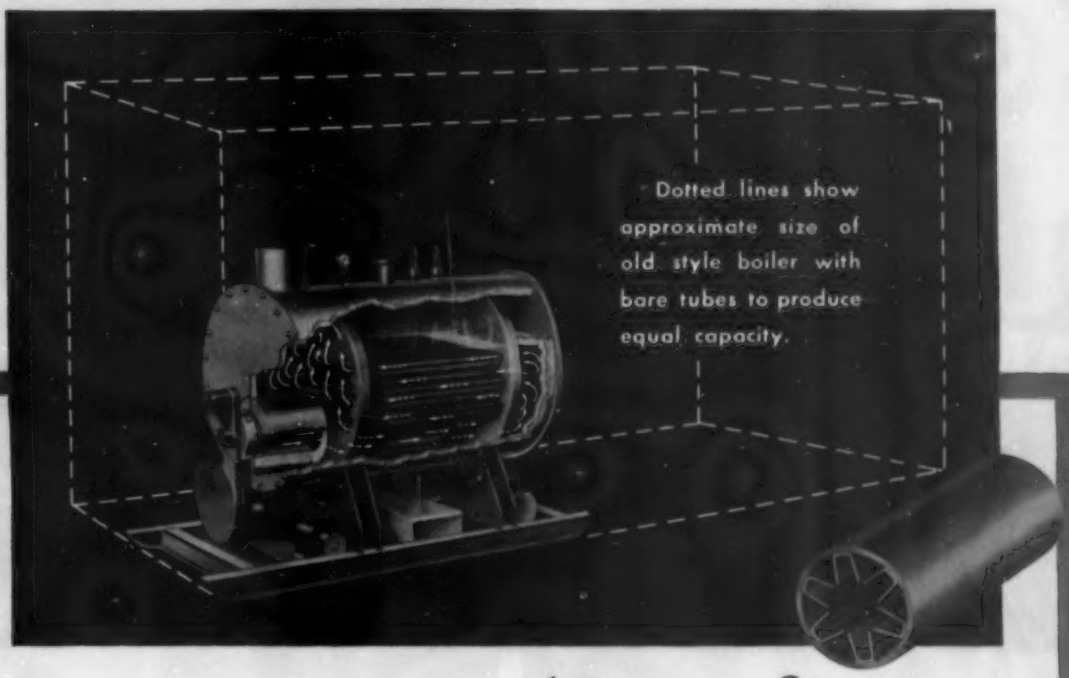
Gentlemen

Please let us know where we may secure an AIEE publication "Recommended Practice for Minimization of Interference from Radio Frequency Heating Equipment" as mentioned in INDUSTRY AND POWER of April 1954, Page 58.

R. E. Light
Assistant Secretary & Treasurer
American Furniture Co., Inc.
Martinsville, Va.

—The American Institute of Electrical Engineers, 33 W. 39th St., New York 18, New York.

new!



BROWN FINTUBE *Boiler*

with integrally finned tubes provides greater capacity in less space

NEW, but already proven in service, our boiler is not a mere modification of conventional, old time boiler design. It reflects our more than 17 years of outstandingly successful experience applying the advantages of extended surface finned tubes to the exacting heat transfer problems of the chemical and petroleum industries.

Now, these same proven economies of the extended surface finned tube have been applied to transferring heat in boilers, where extended surface tubing offers so many advantages.

Due to having much greater fire-side to water-side surface ratio than plain bare tubes — and producing greater turbulence — our boiler extracts the needed heat from the hot gases in just **one pass** through a **short tube.**

This results in much reduced forced draft and stack requirements. The boilers produce more steam from less floor space, and less cubic space. They can be installed where headroom is limited — with consequent additional savings in building costs — come up to full steam pressure in about 10 minutes — require little maintenance.

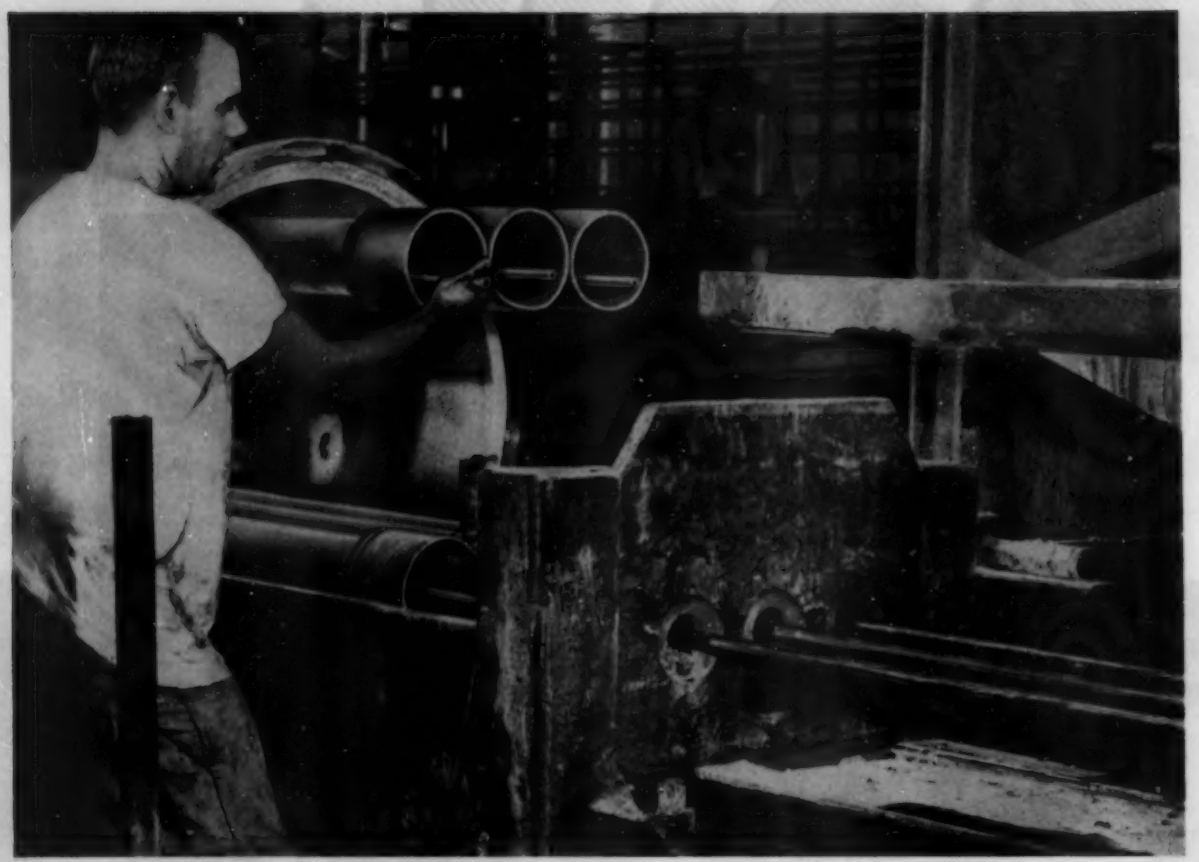
Three standard sizes. Write for Bulletin No. 542 today. It gives full details.

SEVERAL DESIRABLE TERRITORIES STILL AVAILABLE

BROWN FINTUBE CO. *Elyria, Ohio*

NEW YORK • BOSTON • PHILADELPHIA • PITTSBURGH • BUFFALO • CLEVELAND • CINCINNATI • DETROIT • CHICAGO
ST. PAUL • ST. LOUIS • KANSAS CITY • MEMPHIS • BIRMINGHAM • NEW ORLEANS • SHREVEPORT • TULSA • HOUSTON • DALLAS
DENVER • LOS ANGELES • SAN FRANCISCO • BROWN FINTUBE (GREAT BRITAIN) LTD., BIRMINGHAM, ENGLAND • BROWN FINTUBE
(CANADA) LTD., ST. THOMAS, ONTARIO, CANADA • FRIEDRICH UHDE, GMBH, DORTMUND, GERMANY

Circle 523 on Reply Card for more data



New Automatic cold draw bench

Makes Monel tubes up to 85 feet long for high pressure feed water heaters

A new $1,250,000 cold draw section is now in operation at the Huntington Works of The International Nickel Company, Huntington, W. Va.

The unit triples former capacity for producing heat exchanger tubes. In addition, it extends length limitations on some Monel® tubes. They can now be drawn up to 85 feet in length, thus enabling designers to take advantage of greater heating area in tube bundles, and to effect economies by specifying *longer* heaters of *smaller* diameter.

A feature of the new draw bench is an unusual magazine loading device. It consists of a revolving cylinder with a double set of three mandrels. As shown in the photograph, the upper set of mandrels can be loaded for the next draw while three tubes are drawn from the lower set. There's no slowdown, no time wasted.

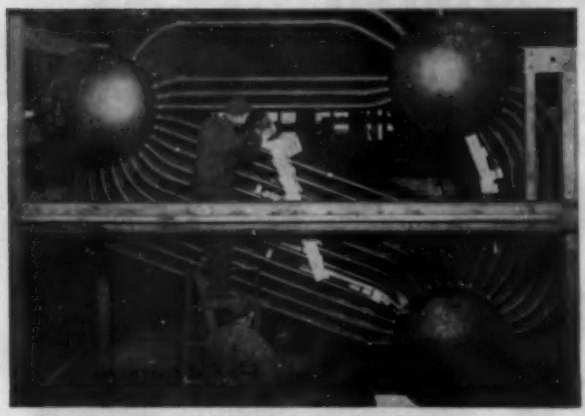
With the new facilities in full operation, prompt deliveries of your Monel tube requirements are assured. Meanwhile, find out more about the many advantages Monel offers. It can, for example, help you improve heat transfer . . . extend exchanger life . . . reduce maintenance costs. Write us — now — for a copy of the bulletin, *Engineering Properties of Monel*. It's yours on request.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

More Power for you . . . with Monel INCO TRADE MARK **Nickel Alloys**

Circle 524 on Reply Card for more data

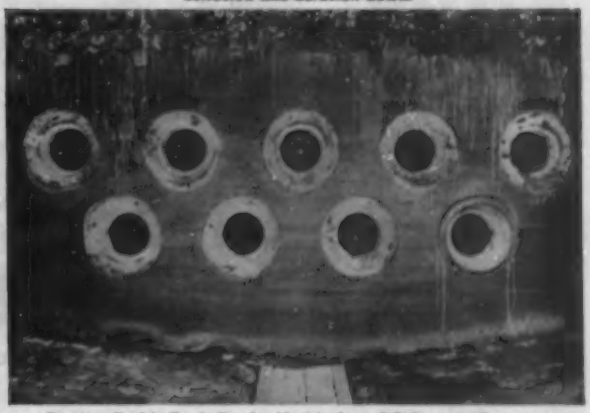
IN POWER PLANTS ON JOBS LIKE THESE:



Monolithic gas-tight baffles of Refractory Concrete are easily made with a castable refractory and simple forms.

Lumnite steel stack linings keep drafts up and costly repairs due to corrosion and abrasion down.

Door linings and other special shapes are easily cast in molds with adaptable Castable Refractory Concrete.



Front wall of boiler is lined with 9 inches of Refractory Concrete—section in excellent condition after a year of service.

Castables save time and cut costs

Power-plant engineers find that castable refractories provide a fast, easy way to place or repair linings in steel stacks, breechings, boiler walls and hearths, doors, coal bunkers and ash pits. Refractory and insulating concrete made with castables can be mixed simply by adding water right on the job, and casting into place. Costs are cut and time saved because they reach service strength within 24 hours—and usually give better service than other refractories.

Castables are prepared mixes of Lumnite* calcium-aluminate cement and special aggregates selected to meet specific temperature and insulation service. They are made by manufacturers of refractories, sold through their dealers, and come ready-made for many refractory jobs.

There is no need to stock large inventories of special refractory shapes—they can be cast as needed. Keep a supply of your favorite brand of Lumnite castable on hand ready for a rush job. For more information write: Lumnite Division, Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Avenue, New York 17, New York.

**"LUMNITE" is the registered trade-mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.*

IP-L-54B

ATLAS® **LUMNITE for INDUSTRIAL CONCRETES**

REFRACTORY, INSULATING, OVERNIGHT, CORROSION-RESISTANT

A UNIVERSAL ATLAS PRODUCT

UNITED STATES STEEL HOUR—Televised alternate weeks—See your newspaper for time and station.

Circle 525 on Reply Card for more data

new bulletins

. . . catalogs from leading manufacturers

200—Valves and Controls

In this four-page booklet you will find illustrated and described a representative few of the many valves and controls made by this company designed for use in the heating, power generating, and industrial process field. The folder gives maximum and minimum pressure limits, materials of construction, and recommends applications for each of the units. Atlas Valve Co.

201—Air-Cooled Engines

Complete specifications on four air-cooled engines—the K90, K160, K330, and K660—are shown in an easy-to-read chart on the inside spread of this folder. Kohler Co.

202—Cranes

Chances are that one of the standard model cranes described in six-page bulletin 154 will fit your particular needs since all cranes made by this company are designed for the least headroom. Single girder, double girder, and box girder cranes are included with general specifications and application data. The Michigan Crane & Conveyor Corp.

203—Gas-Fired Unit Heaters

There is an American Blower gas-fired unit heater to fit your heating needs exactly, according to four-page folder 7017. Units are shown for problem locations such as for low ceiling installation, where operations must be quiet, and shutoff automatic. American Blower Corp.

204—Cooling Tower Efficiency

"Test Your Tower," 19-page bulletin, outlines a simple, direct method by which the purchaser of an industrial cooling tower can assure himself that the performance he purchases is the performance his tower delivers. Results are said to be conclusive when applied to large industrial towers of all types. The Marley Co.

205—Standard Fasteners

Savings in cost and in delivery time by specifying and ordering standard fasteners instead of special products are pointed out in 32-page catalog 10M-BP. Applications of each product in the Unbrako Standards line are indicated in line drawings. Diagrams keyed to specification tables simplify measurement references. Standard Pressed Steel Co.

206—Generator Sets

Generator sets to meet your specific needs are described and pictured in seven-page bulletin G-6. Seven engine models from 60 to 675 hp with generators capable of producing from 50 to 350 kw are included in this "Custom Built" line. Le Roi Div., Westinghouse Air Brake Co.

207—Efficient Operation

"Good Operating Practices," 12 pages, contains the latest recommendations for getting best service out of insulations, packings, refractory products, roofings, and friction materials. Johns-Manville.

208—Air Release Valves

Data sheet 654 describes three different styles of air release valves used for venting air from hot water heating systems, water mains, tanks in pumping systems, water filters, and for releasing air or gas from other liquid lines. Capacity tables show cubic feet of free air handled by various air release valves at different operating pressures. V. D. Anderson Co.

209—Gas Burners

Layout of gas piping, accessories, and fittings for fully automatic high-low operation of the Model R nozzle-mix type gas burners is shown in two-page bulletin 177. Both standard equipment and extra equipment for special applications are listed. Preferred Utilities Mfg. Corp.

210—Measuring Variables

Instrumentation for measuring and controlling process variables is described with suggestions for use in 12-page general catalog 1. How these instruments are combined to form complete industrial packages for measurement of any variable is explained. Fischer & Porter Co.

211—Steam Cost Calculator

Made of heavy board, this Steam Cost Calculator will enable you to read directly cost of steam per hp for installations using oil, coal, or gas. It also gives a direct reading of efficiency of the system. Hapman Dutton Co.

212—Combustion Sampling

The full story of a newly developed sampling system for continuous trouble-free sampling and oxygen measurement of combustion processes is told in bulletin 703. The equipment described is designed for steam generating plants, rotary kilns and driers, open hearth furnaces, and tanks. Arnold O. Beckman Co., Inc.

213—Tube Expanders

Full data on how to choose the proper tube expander for each rolling job is given in eight-page bulletin Y-38. It also describes a complete line of tube expanders for condensers and heat exchangers. Elliott Co., Lagonda Div.

214—Level Indicator

Continuous, precision indication of the changing level of materials in storage is provided by the Belmont Level Indicator, according to two-page data sheet LI-2. Data includes uses of the unit in remote indicating applications where the repeat meter can be located at long distances from the main sensing installation. Thermo Instruments Co.

215—Supports

Prefabricated steel parts designed specifically to give continuous and permanent support to instrument tubing are shown in typical installations in 12-page bulletin 254. Various sizes and shapes and necessary fittings in the system are represented by photographs and dimensional drawings. Instrnf Inc.

216—Oil Filters

Eight-page bulletin F-132 describes in detail construction and operation of hydraulic systems with special emphasis on contamination of hydraulic fluids from various causes, and demonstrates how the correct filtration system eliminates such contamination. Diagram drawings illustrate methods of installing Hilco hydraulic oil filters on various types of circuits. The Hilliard Corp.

217—Battery Maintenance

Users of battery-powered industrial trucks will be able to organize battery maintenance training programs with the use of this 44-page book GB-1599. Material in the training manual was the basis of a traveling maintenance school which visited major industrial centers. Gould-National Batteries, Inc.

Fuel Oil Heaters

Detailed information on dimensions and capacities, and installation diagrams on all models of this company's fuel oil heaters are given in 20-page catalog 743. Tables will help you select the correct fuel oil heater for any heavy oil burning installation. **Please send requests for literature to Manning & Lewis Engineering Company, Dept. IP, 33-42 Ogden St., Newark, N. J. on your company letterhead.**

218—Water Conditioning

The entire line of water conditioning equipment and specialties is briefly covered in four-page bulletin 6210. Where more detailed booklets are available each description carries the identification number of such booklet. Cochrane Corp.

Cooling Tower Selection

New and simplified selection tables for determining correct cooling tower sizes are given in 12-page bulletin 312. All you have to know is the refrigeration load and the cooling range, and design wet bulb conditions. Tables do the rest. **Please send requests directly to Binks Mfg. Co., Dept. IP, 3122 Carroll Ave., Chicago 12, Ill.**

219—Combustion Control

How the Fireye Combustion Control System FJ-2 provides complete protection against explosion hazards of burning fuel is explained in 16-page installation bulletin CF-30. Wiring diagrams and programming sequences are included. Combustion Control Div., Electronics Corp. of America.

Lubricating Oils

Trade-names of over 1200 lubricating oils for heavy-duty industrial engines with properties claimed for each oil are listed in 48-page booklet. **Please send requests directly to Internal Combustion Engine Institute, Dept. IP, 201 N. Wells, Chicago 6, Ill. with 20¢.**

220—Refractory Selection

"A Guide for Refractory Selection," 11-pages, has been prepared as a review of practical refractory problems and their solutions. Applications in both open hearth and electric steel making furnaces are covered, as well as gunning and ramming techniques. Basic Refractories, Inc.

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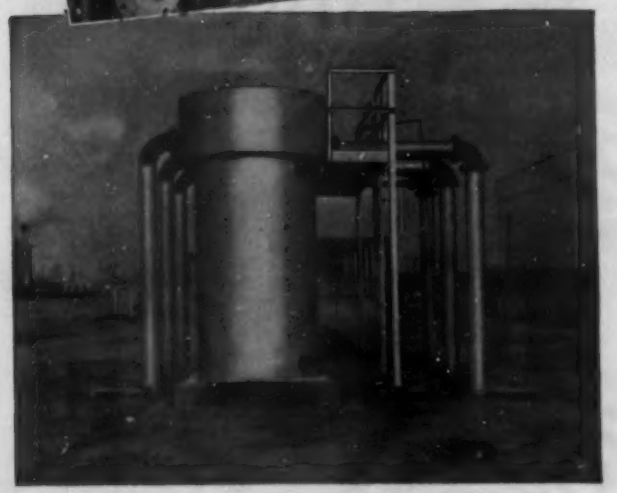
film type exchangers

(Condensers—Coolers—Evaporators)

Patent Nos. 1,935,270 - 2,057,597 - 2,424,441



River water, well water or brackish water are all alike to this exchanger *because it can be cleaned* while in operation! The water distributing ferrules need only be removed successively for the cleaning brush or tool whereby the tubes receive additional water which sluices away the dislodged dirt.

Vogt Film Type Exchangers are operating with real economy of first cost, operation and maintenance in power, petroleum, and chemical industries. They serve as Jacket Water Coolers, Feed Water Heaters, Hydrocarbon Evaporators, Sulphuric Acid Coolers, and Sulphur Dioxide Condensers, and can be designed to cool or heat any liquid and to condense or evaporate any fluid.

TOP: *Four units at Newton Falls, Ohio Municipal plant cool water for diesel engines and a lubricating oil cooler.*

BOTTOM: *Jacket Water Coolers serving engines of 7,300 HP in the compression plant of a Western Oil Refinery.*

[Bulletin HE-7 describes typical installations of Vogt Film Type exchangers and is available upon request.]

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Below are shown two additional EVERLASTING Duplex Units, each including the EVERLASTING "Y" Valve . . . simple and sturdy in design, with all parts interchangeable with those of the Angle Valve.

All EVERLASTING boiler blow-off designs conform with ASME codes, and are available in a range of sizes for pressures up to 600 psig.

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Everlasting Valves

TRADE MARK "EVERLASTING" REG. U.S. PAT. OFF.

EV575

FOR EVERLASTING PROTECTION

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new bulletins

—Starts on page 36

and electric steel making furnaces are covered, as well as gunning and ramming techniques. Basic Refractories, Inc.

221—Belt Conveyors

Belt conveyor components pre-engineered for customer assembly, that can be purchased as a package unit for a complete belt conveyor installation or as repair or replacement units on existing conveyors, are described in four-page bulletin 1454. Stevens-Adamson Mfg. Co.

222—Wrap-Around Heating

The many uses for Heatflex electrical heating units are listed and shown in sketches in seven-page bulletin on heating, de-icing, and pipe-tracing applications. Sample calculations for use in specifying are given with performance characteristic curves to be used for the calculations. Continental Electric Equipment Co.

223—Electrical Maintenance

"Electrical Operation Headaches — How to Cure Them and Profit," considers such problems as wiring, lighting, tele-communications, safety equipment, and electronics. B. Eichwald & Co., Inc.

224—Saving Water

"Water and Process Use" gives examples of how a process water survey, to find out how water is being used — or wasted — in a plant, can have the following benefits: conservation of critical materials; reduction of water use; and savings in waste-water treatment. Hall Laboratories, Inc.

225—Heat Exchangers

Newly revised catalog 1254, 12-pages, contains application photographs from many industries of the Type F Fixed Tube Bundle Heat Exchangers. Of particular interest is a simple yet complete guide to exchanger selection. Young Radiator Co.

226—Coolant Cleaning

How the Kleenall combination magnetic and fabric filter can help solve your coolant cleaning problems, large and small, is described in 15-page bulletin 350C. Filtration Div., Barnes Drill Co.

227—Adjustable Speed Equipment

Principle of operation and use of Dynamatic Eddy-Current adjustable speed equipment is described in 16-page bulletin GB-2. Typical torque and load curves are given. Dynamic Div., Eaton Mfg. Corp.

228—Control of Process Variables

Tel-O-Set recorders and controllers, designed for accurate recording and control of process variables, are shown in 11-page bulletin 7201. Schematic diagrams and pneumatic circuit drawings will give you

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new bulletins

—Starts on page 38

a clearer picture of operation and uses of these miniature instruments. Minneapolis-Honeywell Regulator Co.

229—Condenser Operation
"Proportioning of Surface Condensing Equipment," 30-page booklet 19B6201, gives the latest data and technical information on problems of power plant engineers. It provides formulae of use in calculating performance of a given condenser and carries a variety of curves and tables for quick reference. Allis-Chalmers Mfg. Co., General Machinery Div.

230—Engine Cooling System
"Give the Cooling System a Chance," 11-page booklet, contains many practical suggestions on the best way to care for an internal combustion engine's cooling system. Cummins Engine Co., Inc.

231—Films
"Selected Motion Pictures," the fortieth annual film catalog, lists more than 1400 free-loan and rental films available. Association Films.

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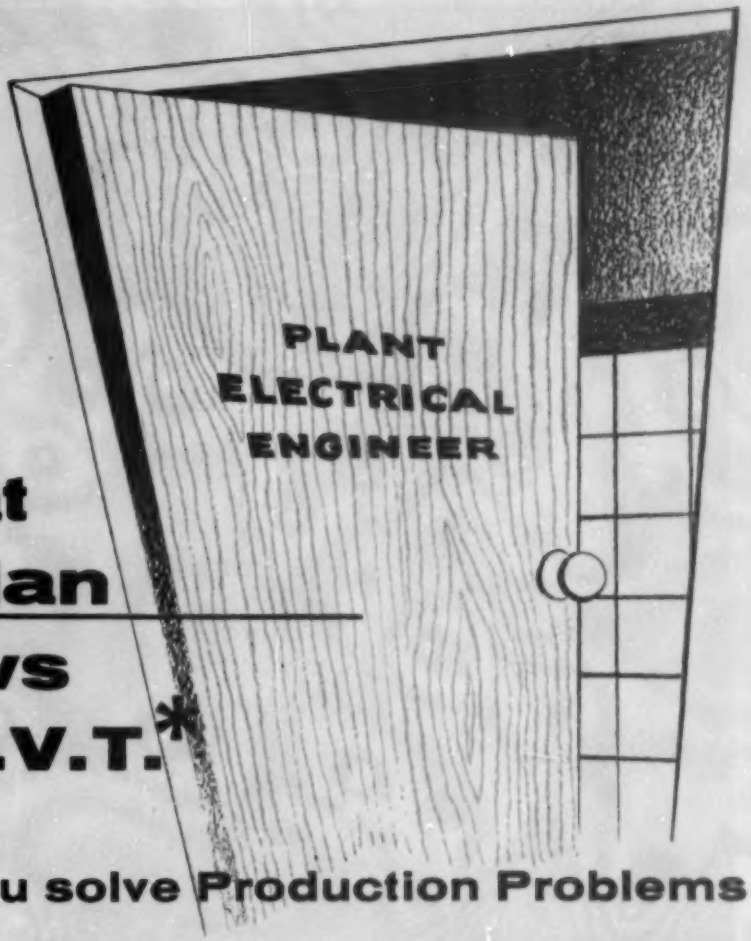
232—Water-Tube Generator
Completely packaged Water Tube Type D Superior Steam Generator in 17 sizes with capacities from 8000 to 40,000 lb of steam per hr, is described in detail in eight-page catalog SM-54. Illustrations show features of construction and operation. Superior Combustion Industries, Inc.

233—Unshielded Cable
The complete story on Okolite-Okoprene 0 to 5000 v unshielded, rubber-insulated, neoprene-sheathed cable is given in 128-page technical catalog OK-1085. Capacity tables, short circuit curves, and methods for determining conduit sizes are among the many useful features of this reference book. The Okonite Co.

234—Filters and Strainers
Quick coupling, non short-circuiting fluid filters and strainers for water, chemicals, and oils can solve many maintenance problems for you according to four-page folder 654-MC. Ronningen Mfg. Co.



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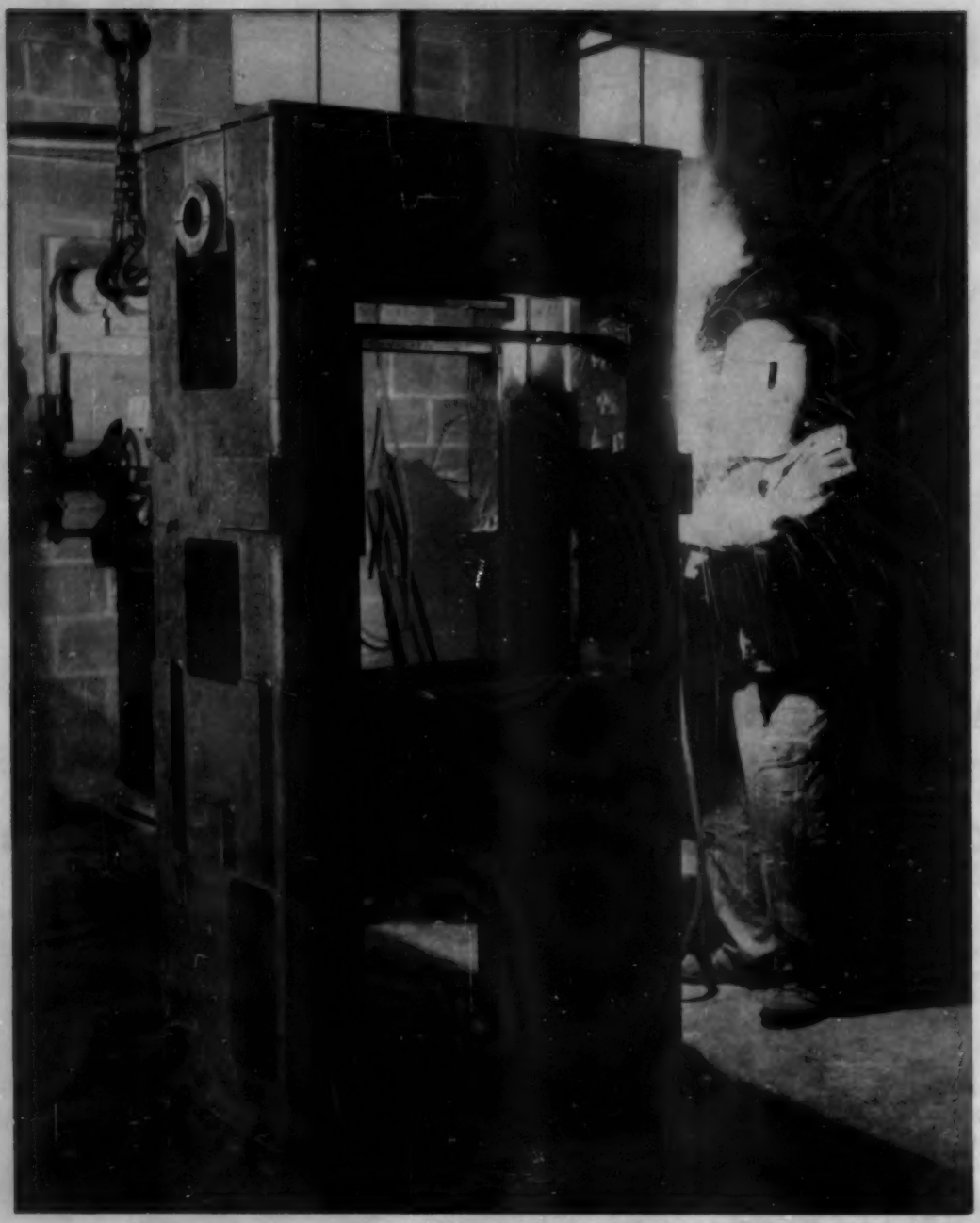

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Photo above is all-steel punch press frame, Tho a third lighter than expensive castings it replaced, greater strength and rigidity of welded construction enable punch press to operate 50% faster.

Besides basic saving of material, plus values are reduced freight and handling costs, easier machining qualities. And future design changes can be made at nominal cost.

Because steel can be formed or cut into almost any size, shape or thickness, doubtless some of your own castings can be replaced by fabricated steel, at really worth-while savings.

Send us a print or a sketch of your product. Or if you wish our engineer will call on you. No obligation in either case.

THE FOSTER COMPANY, Saint Joseph, Mich.

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6 years of operation without one minute of trouble!

■ During six continuous years of start-and-stop operation, the diesel in the Village of Fairfax, Minn., power plant has produced almost five million KW hours of power. Not once in this period has the engine been down for overhaul . . . pistons, cylinders and rings have remained deposit-free and clean.

This extraordinary record of trouble-free operation is traceable to two important maintenance factors: *1.* the job-proved superiority of STANDARD HD Oil . . . an oil specially designed to prevent wear of vital diesel parts and to provide clean operation; and *2.* regular check by a Standard Oil lubricating specialist of all operating data and a periodic analysis of oil samples—all to make sure engines are always operating in top form.

In the photograph above Fairfax Plant Superintendent Frank Chesire (left) goes over operating data with Standard lubrication specialist, A. F. Moldenhauer (right) on one of his regular periodic visits. You too, can put this kind of service to work for you. Call your nearest Standard office. Or write to Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY

STANDARD (Indiana)

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NEW PATENTS

of Interest to Industry

BY Melvin Hoel
PATENT ATTORNEY

Quick Hardening of Concrete

WHEN LAYING FLOORS or concrete slabs of the monolith type, the hardening of the concrete is relatively slow, especially if the concrete is poured in when the temperature is 40 or 50 F. It often happens that after the concrete is poured in the afternoon, the temperature will fall to 40 and the concrete will have to dry or harden several hours before the workmen can trowel or smooth the surface. This causes a needless waste of time.

In U. S. 2,683,916, issued July 20, 1954 to Joseph C. Kelly (Linwood, N. J.), a method is provided such that even if the concrete is just slightly above freezing, the concrete can be poured, and the hardening of the concrete can be so speeded up that in 12 or 13 minutes the workmen can walk or kneel on a strip so hardened and trowel or surface it while the next strip is being hardened in the same manner.

The method makes use of a number of portable copper electrodes 3. Each of these consists of a thin copper plate 4. The copper plate extends up and over the upper edges of the board around the four sides, and is held in place by nails 7. The board may be of wood, composition board, or plaster board. A number of holes 8 are drilled through the entire electrode so that the excess moisture can escape from the concrete as a current is passed back and forth through the mass. The electrodes are electrically connected in parallel to the inlet lead 12, and the other supply wire 13 is connected to the reinforcing rods 2. The electrodes are light in weight and are readily moved from place to place, as desired. They are preferably about 20 in. square, and they have about 80 holes each. Alternating current of 110 volts and 30 amps is used.

Fire Wall & Tank Installation

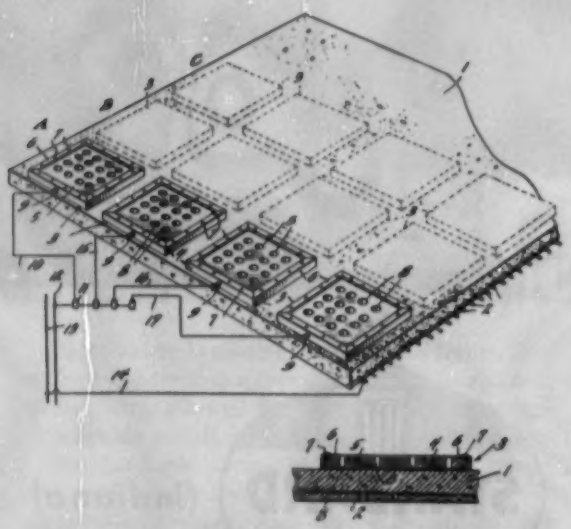
IN PLACES where a large number of horizontal storage tanks containing inflammable materials are installed, very serious fires have sometimes occurred because of the failure of a joint or a section of pipe near a joint under one of the tanks. The resulting escape of large volumes of inflammable liquid, upon ignition, rapidly envelops the nearby tanks in flame. The resulting increase in pressure in the tank bursts the seams of the tanks, adding more fuel to the fire.

In U.S. 2,683,552, issued July 13, 1954 to Gerald L. Brennan and assigned to Warren Petroleum Corp. (Tulsa, Okla.), a fire wall is provided across the end of a battery of tanks, as shown. The rear foundation 8 is formed of poured reinforced concrete, with an enlarged footing 9. The forward foundation (also of reinforced concrete) cradles the tanks and forms the main shield 13 of the fire wall. The top of this shield 13 has a flame-diverting lip as shown. The opposite ends of the shield 13 end in wings 16, thereby forming a three-sided enclosure for the head ends of the tank battery, with a continuous fire-diverting lip extending entirely around the free edges.

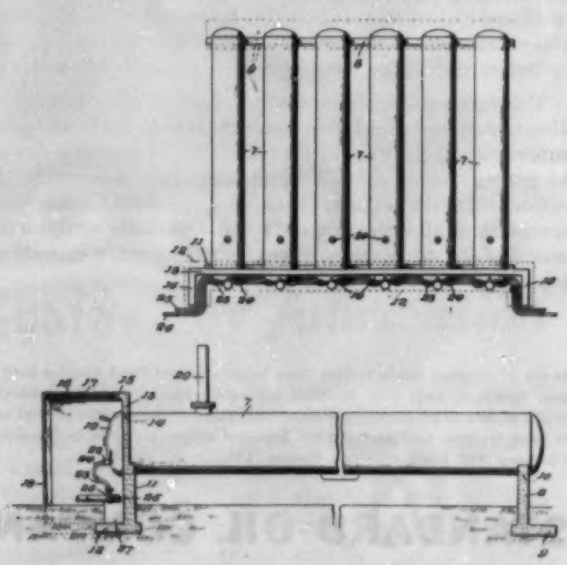
The head ends of the tanks are covered with a fireproof insulation 19 and, with the exception of tank relief valves 20, all connections to the tanks are made through these insulated heads. Thus, valved inlets and outlets are connected by pipes 23 and 24 to supply and discharge headers 25 and 26, which are supported on piping supports 27 formed integrally with the forward foundation 11 and its footing 12. These piping supports are spaced so as to support directly the piping beneath each of the tanks in the battery.

Thus, any fire resulting from leaks in the piping or fittings will be prevented from contact with the tanks proper, at least for a sufficient time to permit fire fighting equipment to be brought into action.

In case of ignition of any of the



Device speeds hardening of concrete in cold weather.



Fire wall protects tank from fire at piping or valves.

1.

2.

3.

4.

5.

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Modern conveyors demand perfect performance from even the smallest part. That's why Jeffrey's smaller replacement parts—like Jeffrey heavier equipment—are all masterpieces of precision and design. Each is made of the best metal for the service, properly treated and formed for accurate balance, close tolerance, smooth surfaces and long, trouble-free service. Your conveyor replacement needs can all be met from one source—Jeffrey! Most parts are now in stock, ready for immediate shipment.

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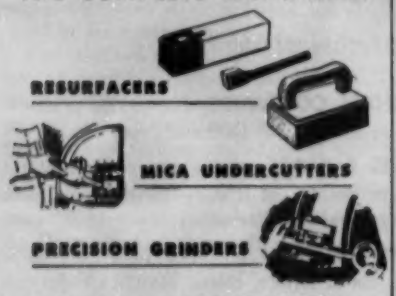

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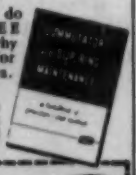

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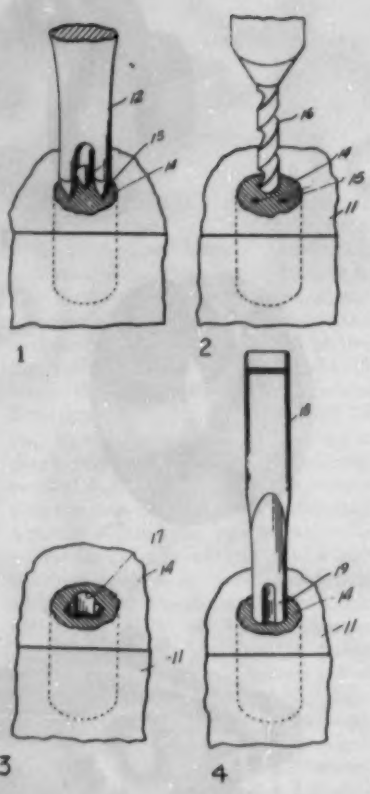
liquid in the zone surrounding the piping and connections, the flame-diverting lips 15, 17, and 18, tend to direct the flames away from the battery of tanks and concentrate them in the confined front area. Thus, the extreme heat generated by such a fire will be prevented from contacting the tanks and causing a dangerous increase in the pressure of the stored fluid.

Backing Off Broken Studs

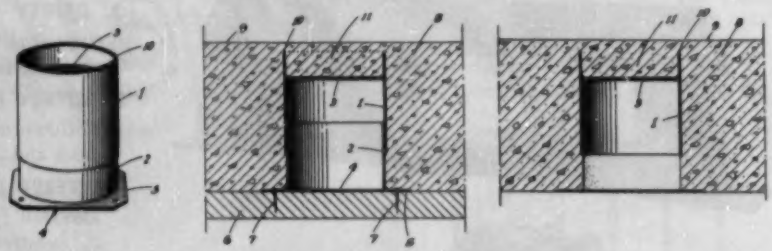
IN BACKING OFF a broken stud, a single round hole is generally drilled in the end of the stud, and then a round extractor is inserted in the hole and turned to back off the stud. However, a round extractor does not provide as much gripping action as desirable.

In U. S. 2,684,526, issued July 27, 1954 to John D. Hoover (Victorsville, Calif.), a method of backing off studs is described which provides a better gripping of the broken stud.

The method is shown in the illustrations. A centering punch is illustrated in position on the end of the stud for forming points. Next, a drill is centered on one of the points and a hole drilled into the end of the broken stud. After each point has been drilled, the completed hole will be in a clover shape, and the extractor is inserted and turned to unscrew the broken stud from the casing in which it was imbedded.



Method for Forming Holes in Concrete Slabs



A NEW PATENT, U. S. 2,684,518, issued July 27, 1954 to Leslie A. Whitlock (Stockton, Calif.), provides a method for forming holes in concrete slabs for utility conduits, or outlets.

The metal device shown is used for this purpose. It consists of a female sleeve 1 and a male sleeve 2 telescoped in it. Near the outer end of the female sleeve is a baffle disc 3, and at the bottom of the male sleeve is a flat plate 4.

In use the plate 4 is nailed to the inner face of the form 6. After the device has been nailed down, the female sleeve is adjusted so that the overall height is slightly less than the total thickness of the slab 8 to be poured. After the concrete has set, the form 6 is stripped, carrying with it the male sleeve. The female sleeve and the baffle disc remain in the concrete slab, the plug 11 making the hole blind at the top.

When it is desired to complete the hole through the concrete slab, the baffle disc 3 and concrete plug 11 are driven out. This is easily accomplished, since the concrete needs to be fractured only in the small distance between the rim 10 and the surface 9. This fracturing occurs quite cleanly.

Two other modifications of the device are also described in the patent.

Pennsylvania R. R. saves $33,000 a year by burning coal the modern way

The Lafayette Street Power Plant of the Pennsylvania Railroad in Fort Wayne, Indiana, heats a passenger station, office buildings and repair shops. In addition, it also supplies steam for power, processing and car heating. To increase the efficiency of this coal-fired plant, the railroad replaced its old boilers with modern steam generating equipment, regulated by automatic combustion controls. At the same time, they modernized the ash removal system.

Today the cost of steam generation has been lowered from 77c to 59c per 1,000 pounds and combustion efficiency raised 25% higher than before. Overall heating costs have been cut $33,000 yearly.

Investigate Your Fuel Costs

If you're planning to modernize your plant or build a new one—or if you are just interested in cutting fuel costs—find out how coal, burned the modern way, compares to other fuels. Talk to a consulting engineer or your nearest coal distributor. Their advice may save you thousands of dollars every year.

facts you should know about coal

In most industrial areas, bituminous coal is the lowest-cost fuel available.

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For further information or additional case histories showing how other plants have saved money burning coal, write to the address below.

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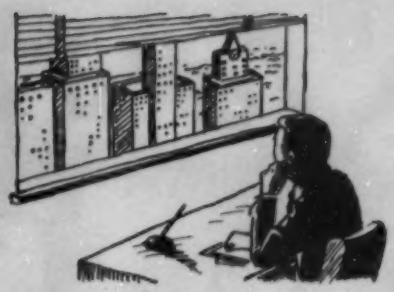
Out Our Window



THE CAREFUL READER of this issue of INDUSTRY AND POWER might come to the conclusion that the Editor had just bought stock in a run-down coal mine or recently tied-in with a coal handling railroad. Two of the feature articles deal with coal fired steam plants and coal handling equipment. Actually, our only connection with coal mines is a distant relative in West Virginia who has a small seam running through his back yard. Our connection with the railroads is even more remote. In fact, we are particularly angry at the C&O for having taken off the club car on their Chicago-Grand Rapids run.

On the other hand, we are very much interested in coal and coal handling because we firmly believe that the future for coal as a fuel depends to a considerable extent on the development and use of better handling equipment and firing methods.

Many of the powers in the coal lobby, and parts of the railroad lobby, have the impression that the way to sell coal is to impose restrictions on the oil and gas producers and distributors — pass laws to prevent the importation of fuel oil — fight the granting of franchises for pipelines — generally hinder the distribution and sale of gas and oil.

We do not agree with those ideas. We believe that gas or oil is a far better and more economical fuel for some applications, even though in most of the heavy industrial areas of this country coal is, Btu for Btu, the cheapest fuel available. We think that the user should be as free as possible to choose the fuel he wants on as free a market as can be obtained. The coal boys would be smart to stop their fooling around in Washington and the State capitals and start investing their time and money in the development of industrial equipment that would make coal easier to handle and easier to burn — equipment that would take away many of the selling points of oil and gas.

The trouble is that coal all too often involves a man with a shovel — and an atmosphere full of coal dust. The engineer faced with the problem of selecting equipment for a new steam plant is very likely to think of the ease with which the oil or gas burner can be turned on and adjusted, the ease of housekeeping — and he stays awake at night trying to find every possible way to justify the higher fuel cost of gas or oil.

Considerable progress has been made in the development of coal handling equipment. The article in this issue describing the boiler installation at Highland Park Mill, in Charlotte, N. C., is an excellent illustration of how automatic handling can be applied to even the medium size or small plant. That is where such equipment is needed. The large utilities with their central stations have for many years been able to handle coal automatically and cleanly, but until recently the smaller plants have found it more practical to go to oil or gas and thereby avoid the manual handling associated with coal.

The other problem, coal dust, is also unnecessary. Its nuisance can be eliminated at a cost of less than 1½¢ per ton. The article on dust control in this issue tells of the experiences of three companies, DuPont, International Harvester, and Hiram Walker in ridding their coal handling areas of dust.

As should be expected, the improvements in coal handling and the methods for eliminating coal dust are the result of work by private industry — commercial companies with products to sell. There is every reason to believe that this type of research will continue and be fruitful, but we think it would be wise if the coal industry were to do less wrangling in Washington trying to undermine oil with legislation and spend more of their money in research on coal handling. Their customers would appreciate the results and the coal salesmen could afford to give away better quality cigars.

A little money could also be spent to find some reasonable use for the relatively small amounts of fly ash collected by the small and medium size plants. Big fly ash producers like Detroit Edison and Philadelphia Electric have found some sale for their fly ash in quantity, but the plants producing one to ten tons of ash a day still have to pay to haul it away and have to find a spot to dump. Some small industrial communities are becoming islands surrounded by fly ash.

The expense account of one Washington Wash-Room Diplomat would hire a couple of good research men.

Incineration odors washed away at World's Largest Clinical Center

Two double door incinerators dispose of refuse from research and clinical activities.

ANOTHER FIRST FOR SCHNEIBLE MULTI-WASH COLLECTORS . . .

This model research center, a branch of the U. S. Public Health Service, has incorporated for the first time a Multi-Wash system in conjunction with its incineration plant to eliminate offensive odors and acrid smoke.

Two giant incinerators handle all refuse from the several institutes comprising the National Institutes of Health. Discharge from these incinerators goes through two Schneible type "IC" Multi-Wash Collectors before it is exhausted through the stacks. Emissions show no discoloration, only water vapor, and no detection of odors.

Each Multi-Wash Collector can handle a gas volume of 46,000 lbs. per hour which consists of 1,600 lbs. of water, 2,300 lbs. of combustible material and 42,100 lbs. of air.

These Multi-Wash units are constructed of ⅛" stainless steel. Exhaust fans are of standard steel. Both are coated with corrosive resistant material.

A master control panel has circuits interlocked with the incinerators and Multi-Wash system for most efficient operation.

This installation, we believe, is the forerunner of better, more efficient air pollution control for similar institutions throughout the country.

Schneible engineers with their many years of experience in air pollution control, can help you provide better, healthier surroundings.

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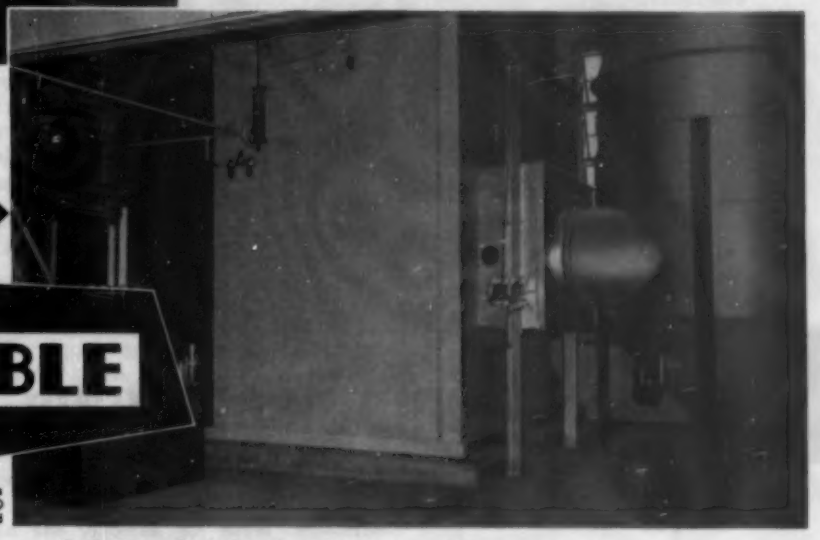
Overhead exhaust fan installation for Schneible Multi-Wash Collectors.



View of one of the Multi-Wash Collectors as installed at base of stack behind an incinerator.

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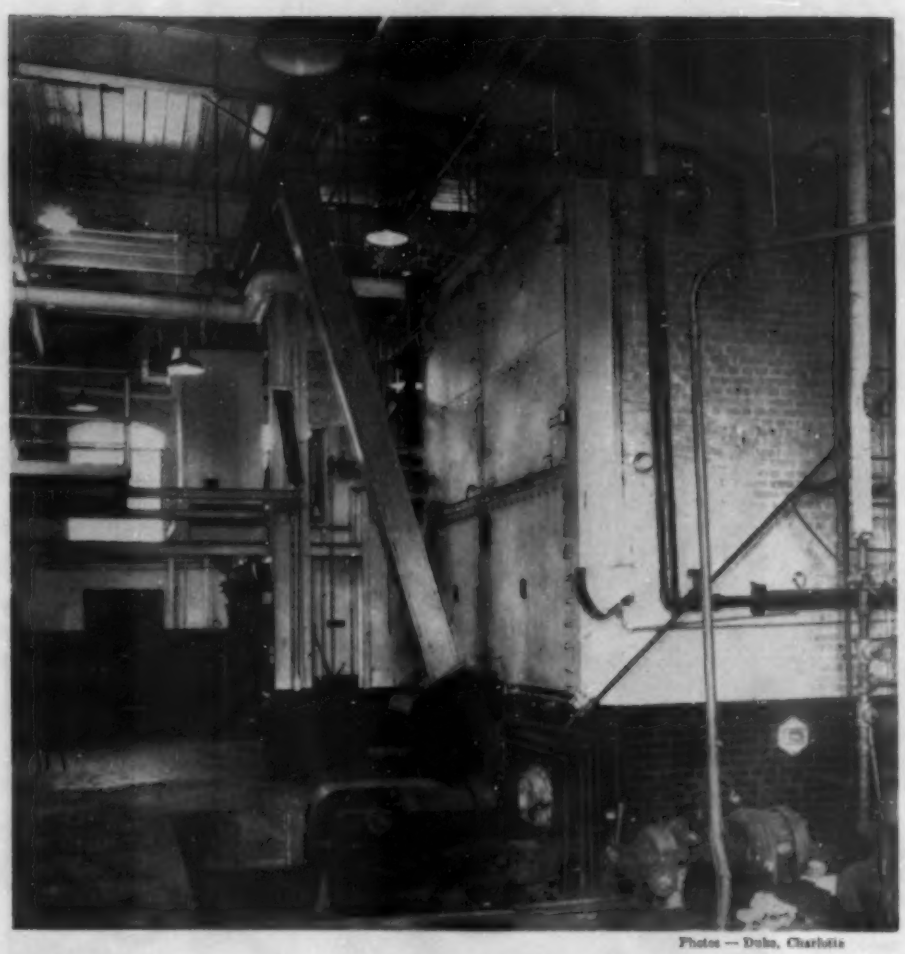


View of the firing aisle shows the overhead screw conveyor, bunker over the new spreader stoker, coal chute to old boiler, and steam header platform.

Photos — Duke, Charlotte

Engineered Design Plus Modern Equipment — Big Savings for a Small Plant

I&P EXCLUSIVE

N. M. FOWLER
Consulting Mechanical Engineer
B. O. Vannort Engineers, Inc.

THE INSTALLATION of a new, 25,000 lb per hr boiler and modern auxiliaries at Highland Park Mill No. 3, in Charlotte, N. C., has resulted in a savings of 20 percent in fuel in spite of an increased load to meet an expanded steam demand. The boiler is designed to permit firing of coal, oil, or gas in a single furnace — a farsighted design feature. Fuel economy is excellent, and the safety devices are unique, setting this plant apart from other installations of comparable size.

Many of the problems accompanying the modernization and expansion of existing steam generating facilities are more challenging than those encountered in the design and construction of an entirely new boiler plant. Frequently, however, the ultimate results provide greater satisfaction because the marked contrast between the old and the new highlights the degree of successful accomplishment. The boiler plant at Mill No. 3 of the Highland Park Mfg. Co. is a representative example. At this plant careful coordination of engineering detail, proper utilization of high quality equipment, and intelligent application of control and safety devices combined to produce a highly efficient installation.

The principal problems at Highland Park were the ones common to many industrial plants. A swing-

ing load over a wide range was characteristic of the demand, and expanding production necessitated an increase in steam capacity. Rising labor and fuel costs indicated operating economy should be improved. All efforts were directed at meeting these objectives with a minimum capital expenditure while also assuring convenient, trouble-free operation and providing adequate protection for both personnel and equipment.

Design Considerations

When compared with installations of even a decade ago, this new unit may appear to be mechanically complex, but its operation is much simpler than its earlier counterpart. In addition each item of equipment is justified by one or more of the several pertinent factors.

¶ Modern heat transfer equipment has numerous inherent advantages, but close regulation of all variables is required to sustain high efficiency and design capacity and to provide long life with minimum maintenance. Control equipment assumes added importance, and the system layout must be carefully designed.

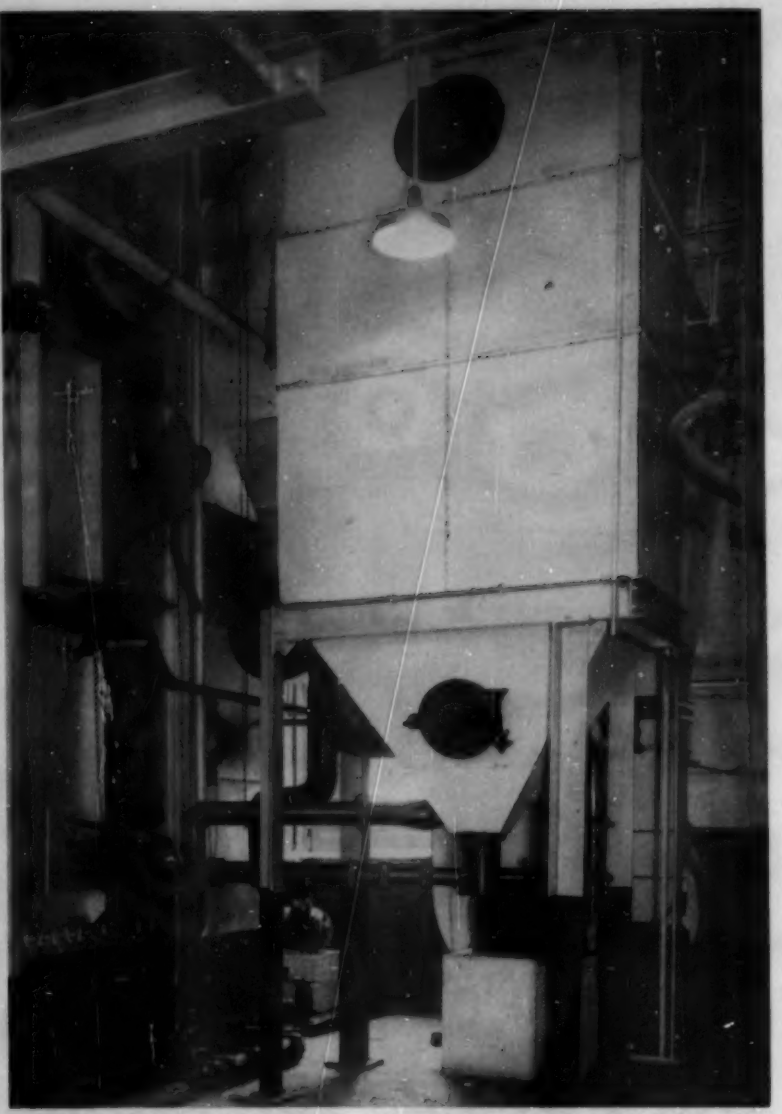
¶ Safety codes and insurance requirements now are more exacting than ever before. Besides providing for the safety of the operating personnel, protection is required against the problems and expense caused by a disruption of production schedules or the necessity of repairing or replacing equipment at today's high costs. These conditions demand the use of adequate safety devices.

¶ In the Charlotte, N. C. area, as in most localities, codes place limits on the amount of fly ash, odors, and other objectionable byproducts of industrial processes discharged to the atmosphere. Even without restrictions, however, these costs of preventive facilities have proved economically justified by improved performance. Community goodwill adds further benefits.

¶ Personnel requirements must be studied, particularly at current wage rates. The preliminary study for this installation indicated that labor saving devices such as automatic coal handling equipment would serve to minimize the personnel complement and thus provide savings in operating costs.

¶ With minimum personnel in attendance and operation dependent on complex controls, the design must be as nearly "foolproof" as possible to avoid human errors.

¶ Economics dictate the necessity of incorporating equipment that will improve the over-all efficiency.



Dust collector, cinder return system, and ID fan are between the two boilers.

Of course, wherever possible, the costs of equipment over and above the essentials should be evaluated both on an economic basis and in terms of the specific project conditions. This was done at Highland Park, and it was decided that the costs of little refinements represent only a very small percentage of the total costs but serve to separate an average installation from one that is outstanding. Often such desirable extras result in better care and protection of the equipment, cleaner and more dependable operation, and a longer useful life for the plant.

Scope of the Project

At the start of the expansion program the existing boiler room contained one, 17,000 lb per hr steam generator and one, 12,400 lb per hr unit. The larger unit, which normally carried the total plant load, was about 10-years old. The smaller unit, used mainly during outages for maintenance and inspection of the larger unit, was 25 years old. Both boilers were underfeed stoker fired, and the fuel was handled manually.

Although no steam flow meters were available, the plant personnel had an accurate knowledge of both the current demands and the anticipated additional requirements. These data indicated the smaller boiler should be removed and replaced by a 25,000 lb per hr steam generator. Evaluation studies showed this unit should operate on coal initially, but

that provisions should be made for the future addition of oil and gas firing equipment without removing the stoker. This arrangement would provide the advantage of three fuel selection based on prevailing fuel cost differentials.

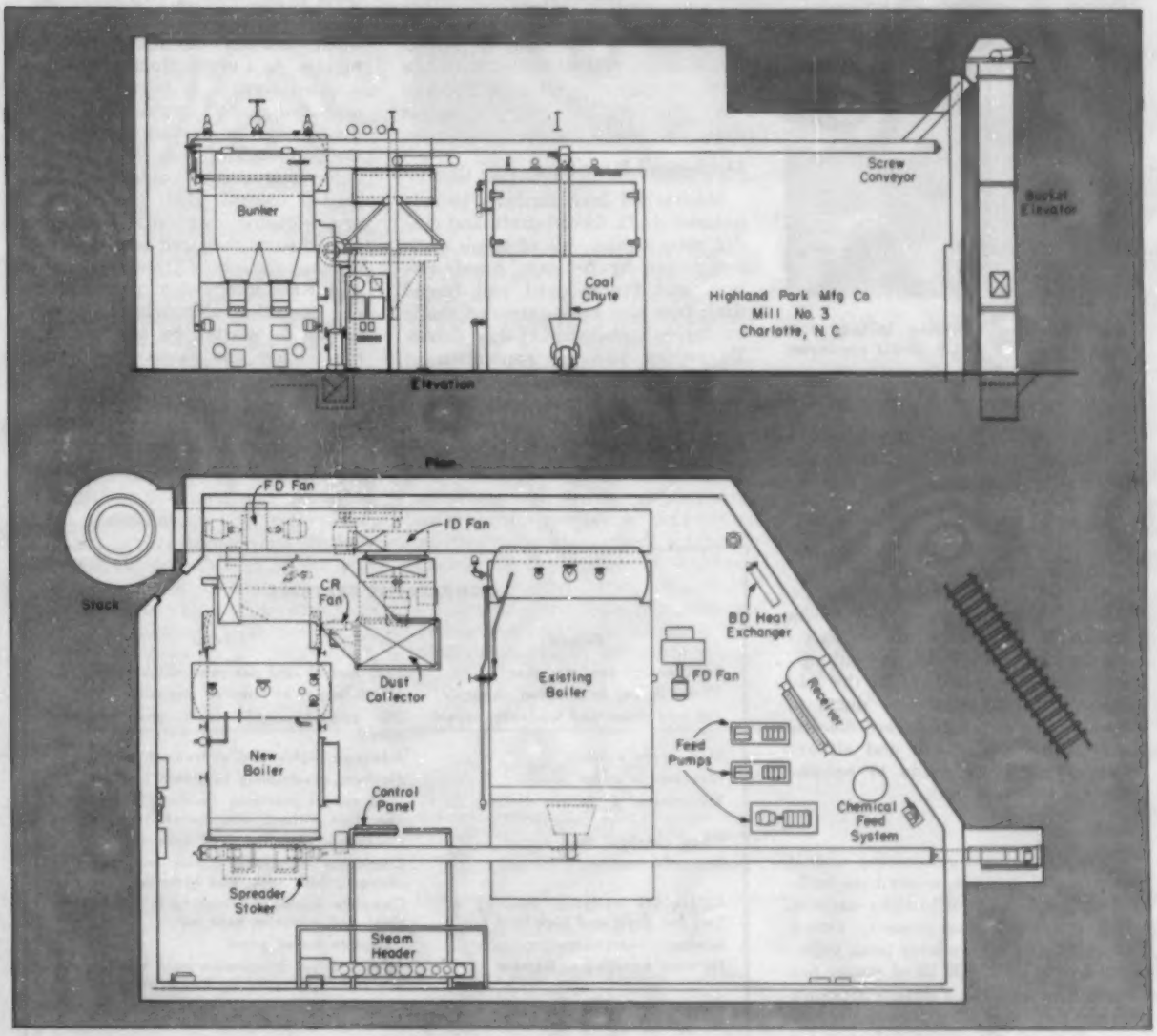
Since the operating economy of the existing plant was poor, the modernization program included many changes in addition to the installation of the steam generator and its auxiliaries. The entire electrical system, both power and lighting, was renewed, and the existing steam header and a major part of the steam piping were replaced. Steam piping, ducts, and breeching —both existing and new—were insulated. Additions included: a coal handling system, a continuous blowdown flash tank and heat exchanger, a proportioning chemical feed pump, complete combustion controls, an alarm system, a plant drainage system, catwalks, platforms, and trenches. Other changes and improvements to existing facilities also were accomplished at a minimum of cost by incorporating the work with the new installation.

Planning Details

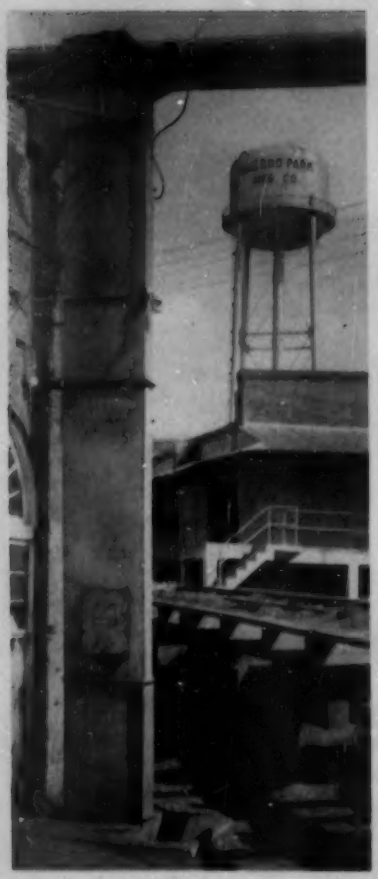
When planning a project of this type, the selection and arrangement of the equipment are most important. Mistakes made in the sizing of basic components can be costly, while a hasty decision regarding arrangement can mean dissatisfaction for the entire life of the installation. It may be true that unused floor space is costly overhead, but an installation that is cramped also can be costly from the standpoint of operation and maintenance.

In existing plants, layout problems are more complicated because space limitations will of necessity influence system design. At Highland Park the area occupied by the existing unit was not adequate for the new steam generator and its auxiliaries, so the north plant wall had to be moved out four feet. Part of the roof was raised, and the entire roof was rebuilt. Even with these changes, space limitations prevented the installation of an economizer although evaluation studies showed it was justified.

Arranging the sequence of operations for removing and replacing



Plan and elevation views show the arrangement of the boiler plant equipment after completion of the expansion project.



Coal handling facilities include this bucket elevator and a screw conveyor.

a boiler without loss of production is another major problem. Generally the existing unit must be kept available for emergency operation until the last possible minute. At this plant the details were worked out so that the steam was off only twice, each time for 8 hours on weekends. During these periods, a new steam header was connected to the existing distribution system, and old piping was dismantled after the old boiler was removed. Gas ducts to the existing breeching were disconnected and sealed off, and all arrangements were made to accommodate the new unit.

Boiler

The new steam generating unit is an integral furnace, water tube boiler with 3068 sq ft of heating surface. It has a continuous capacity rating of 25,000 and a two-hour peak capacity rating at 27,500 lb of steam per hour. The unit has a design pressure of 250 psig, and all piping and component parts also were selected for this pressure although current operations are at 150 psig. The boiler is constructed for the future addition of combination oil and gas burners in the side wall without disturbing the present stoker grates.

Spreader Stoker

Currently, the plant operates on nut and slack coal. This fuel is fired by a two-feeder, spreader stoker with dual motor drives and steam powered dumping grates. The stoker has a net effective grate area of 69.6 sq ft, and the system includes provisions for total reinjection of cinders (from both the boiler passes and the dust collector) with the supply of secondary air.

With the spreader stoker firing, a dust collector was required by the local code to minimize stack discharge. A mechanical type unit of standard design was selected and installed at the rear of the boiler room between the new steam generator and the remaining boiler. Gases enter this collector from the top and discharge through the rear side, making a compact layout ideally suited to the available space.

Mechanical Draft Fans

Mechanical draft facilities include induced draft, forced draft, and cinder return fans. All of these units are driven by constant speed motors, and the induced and forced draft fans also have extended shafts for future installation of dual drives. To reduce power consumption of the drives, inlet vanes are used for control of the forced draft fan and an inlet damper for control of the induced draft fan. The ID fan also has an outlet damper to permit use of the natural draft boiler while doing maintenance work on the fan.

Coal handling equipment consists principally of a bucket elevator, with ground level feed hopper, located outside the plant adjacent to a railroad trestle. An overhead screw conveyor runs the length of the boiler room. The screw conveyor delivers coal to the older unit through a chute to the stoker hopper and also supplies a new bunker above the spreader stoker. Design capacity of the system is 7 tons per hour, while the bunker for the new boiler holds an 8-hr coal supply.

Coal System Operation

With the exception of unloading cars and filling the outdoor hopper, the system is fully automatic. Controls start the elevator motors when the coal in the bunker drops to a level approximating two hours supply. After the bunker has been filled, another control stops both motors. As a precautionary measure, a third control is wired in series with the shutoff control to provide dual protection against overfilling of the bunker. The chute supplying the older unit also is equipped with a shutoff control. Both the conveyor and elevator controls are interlocked so neither unit can be started without the other. Transfer switches also were included to permit manual operation although the system cannot be started by any means if the bunker and chute are full.

Feedwater flow and chemical feed controls were provided. The feedwater regulator is a two-element unit, operating on the principle of a primary impulse from steam flow

COMPARATIVE FEATURES

Before	*After*
3526 tons of coal per year	2820 tons of coal per year—20% saving
29,400 lb per hr installed capacity.	42,000 lb per hr installed capacity.
125 psig steam and feedwater system.	250 psig (design) steam and feedwater system.
Inadequate lighting.	Adequate lights and convenient outlets.
Inaccessible steam header.	Platform accessibility to steam header.
Minimum of protective devices.	Dual system providing for daily checking of operation without interruption.
Batch chemical feed system.	Continuous chemical feed system.
Manual blowdown.	Continuous blowdown system with heat exchanger, flash tank, and sampling top.
Inadequate insulation, resulting in very hot plant and high heat loss.	Complete insulation, resulting in comfortable plant and minimum heat loss.
Minimum instrumentation.	Complete boiler panel.
No coal handling equipment.	Adequate but inexpensive coal handling system from coal yard to bunker storage.
Manual operation of plant.	Complete pneumatic combustion controls, alarm system, and protective devices.

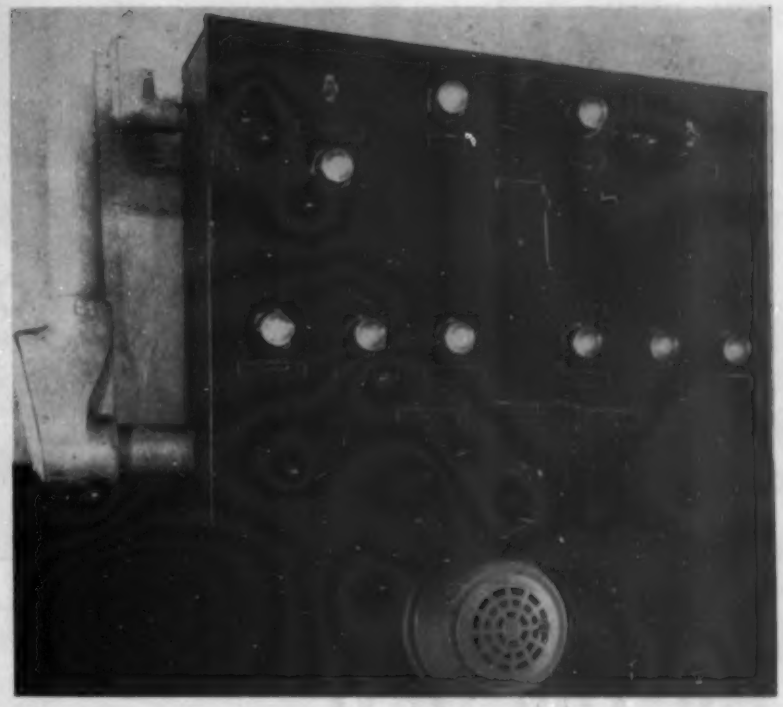
and a secondary impulse from water level to modulate the feedwater flow rate. Chemical feed also is continuous, with a proportioning pump picking up solution from a tank and injecting it directly into the boiler steam drum. The control system for this pump includes a low level limit which de-energizes the pump and sounds an alarm when the solution tank has been drained.

Continuous blowdown facilities were installed for water quality control. The system contains two blowoff valves (connected in parallel to allow for the maintenance of either valve), a flash tank, and a coil type heat exchanger that utilizes the waste heat to raise the temperature of the makeup water. A needle valve provides a test collection connection. Daily samples are analyzed to assure accurate control of the boiler water concentration.

Controls and Safety Devices

Complete pneumatic combustion controls govern the operation of the new boiler. A fuel-air ratio controller regulates the speed of the stoker feeders and positions the forced draft fan inlet vanes in accordance with the steam demand. A draft regulator maintains constant furnace conditions by controlling the inlet damper on the induced draft fan. Performance of the system can be constantly checked at the control panel which includes: a steam gage, three-point draft gage, recording boiler efficiency meter, and pressure-temperature recorder.

To assure adequate protection for the equipment and continuity of service a dual system of alarm and protective devices was installed. This system offers low water shutoff; protection against loss of control air (in anticipation of the unit being gas or oil fired at some time in the future); and protection against high water to assure a high quality of steam.



Dual protective system includes panel-mounted controls and visual indicators.

Normally both sets of devices are in the circuit, but by transfer switch, each set can be removed from the tripping circuit without being de-energized while the other set continues the protection. This allows the operator to periodically trip each actuating device to be sure that it is functioning properly. In addition, the motor controllers for the fans, stokers, and coal handling equipment were all wired for sequential operation, assuring coordinated starting procedure and protecting against an uncoordinated shutdown sequence, normal or emergency.

Currently one man per shift operates and maintains all equipment in the boiler room. Efficiency is consistently high, and the plant is kept much cleaner than was previously possible. As a further aid to housekeeping, a portable vacuum unit was purchased because the beneficial effects of a clean plant are numerous. Personnel have a greater pride in the plant, and the equipment receives good care, assuring long life.

The management is naturally pleased with the major fuel savings of 20 percent, and the engineering staff is impressed with the ability of the unit to hold pressure despite the wide and frequent demand fluctuations. Controls, stoker, and other auxiliaries function together to make possible the high over-all efficiency of the new unit.

PRINCIPAL EQUIPMENT

Boiler	The Babcock & Wilcox Co.
Boiler setting	Piedmont Products Co.
Spreader stoker	Detroit Stoker Co.
Dust collector	Western Precipitation Corp.
Forced and induced draft fans	Sturtevant-Westinghouse
Cinder return fan	Buffalo Forge Co.
Fan motors	Allis-Chalmers Mfg. Co.
Soot blowers	Diamond Power Specialty Corp.
Combustion controls and instrumentation	Bailey Meter Co.
Feedwater regulator	Copes-Vulcan Division
Water level protection	The Mercoid Corp.
Water column	Reliance Gauge Column Co.
Coal conveying systems	Link-Belt Co.
Coal bunker level controllers	Bin-Dicator Co.
Chemical feed system	Milton Roy Co.
Continuous blowdown system	Cochrane Corp.
Steam gage and safety valves	Manning, Maxwell & Moore, Inc.
Blowoff valves	Yarnall-Waring Co.
Pipe and fittings	Grinnell Co., Inc.
Pipe and hot gas duct insulation	Reid-Hayden, Inc.
Electrical controls	General Electric Co.
Electrical contractor	McClain Electric Co.
Boiler and equipment erection	Highland Park Mfg. Co.
Engineering	S. O. Vonnert Engineers, Inc.

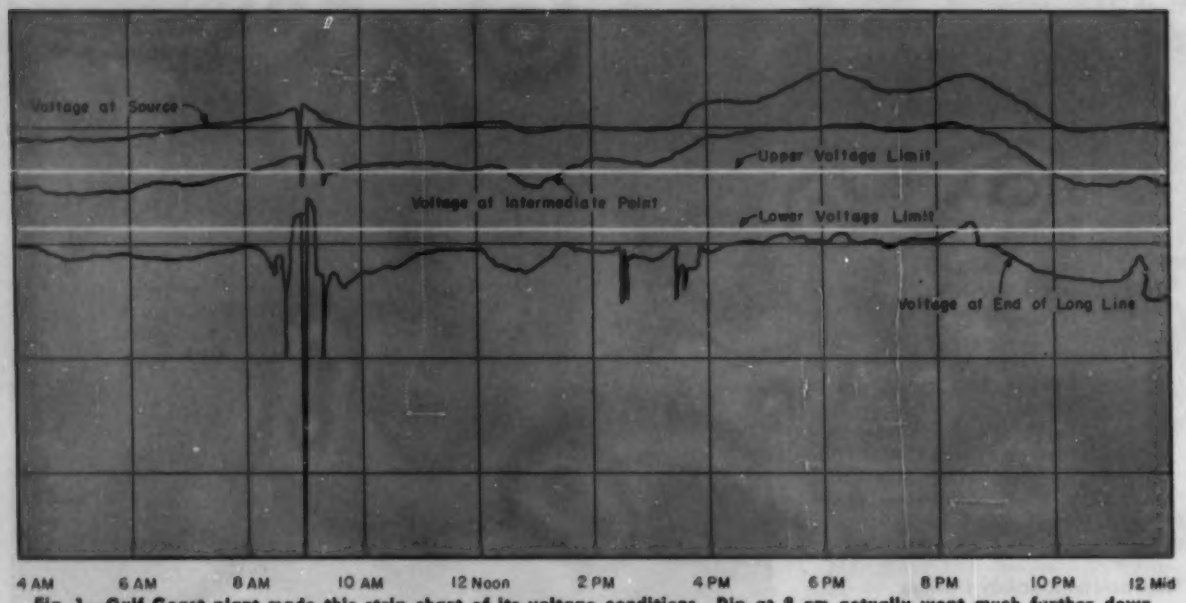


Fig. 1—Gulf Coast plant made this strip chart of its voltage conditions. Dip at 9 am actually went much further down.

Do You Have True Voltage Control

I&P EXCLUSIVE

Regulation is too often the only factor associated with voltage control. Equally important, though, are the maximum and minimum limits within which the voltage swings.

HAROLD E. McCONNELL
Consulting Engineer

VOLTAGE CONTROL has two distinct aspects. The first, and most important, is that of the maximum and minimum voltage limits applied to the electrical devices on the system. The second is that of voltage regulation.

Many plant engineers think they have voltage regulation problems when in reality they have problems of voltage limits. Many plants may have both problems to a severe degree. In general, either problem invites the other. Both aspects of voltage control — limits and regulation — must be accounted for to give real voltage control at each power-consuming device in the plant.

Voltage regulation is defined as the percentage variation, referred to full-load voltage, that occurs between no-load and full-load. It is expressed by a simple formula:

$$\text{Percent Regulation} = \frac{100\ (E_n - E_f)}{E_f}$$

where E_n is the no-load voltage and E_f is full-load voltage.

Applied to a system or to an individual piece of equipment, regulation is one good criterion by which to judge the adequacy of the system or equipment. Obviously, low regulation is highly desirable in electrical systems since it indicates little voltage drop upon application of load. But regulation does not express the problem of voltage limits. It also leaves out the factor of time.

Good systems first set limits on the voltage to be applied, and then maintain regulation so that the system voltage will not go outside of the maximum or minimum limits. Regulation is different at each point on a system, and calculations must be made for each critical point.

The regulation formula does not mention that the supply voltage, E_n, is nearly always an independent variable—influenced both by the plant's generator and utility system regulation. Nearly all utility companies maintain excellent regulation at the customer's service entrance, but this does not mean an absolutely constant supply voltage. This supply voltage varies from hour to hour and day to day, usually within limits of ±5 percent.

Flicker

The voltage variations in a plant system occur as a function of time; if the voltage variations in the aggregate are slow in occurring, the time element can be ignored. The

problem is then simplified. Fast variations of voltage cause "flicker," an effect easily recognized by changes in lighting intensity. Annoying headaches and eyestrain are frequently caused by rapid flicker, even if it occurs within otherwise tolerable limits of voltage. Other effects may occur in control apparatus, where excessive voltage flicker may cause erratic or incorrect sequencing.

Inrush Currents

Most objectionable flicker is caused by large inrush currents during the starting of motors. Assuming that under steady load the system barely holds its voltage between the required no-load and full-load limits, large inrushes may double or triple the system voltage drop. In some instances this is not particularly harmful. In others the flicker may cause control relays to drop out —thus shutting down motors near the ones starting up. Other motors may lose required torque.

Many motors will not start at all if the starting voltage drops too low; instead, they will groan and burn until an overload relay finally comes to the rescue. The voltage rises when the dip in the applied voltage passes, and the overload relay then throws the already hot motor back on.

The curves in Fig. 1 are reproduced from actual voltage readings recorded in a Gulf Coast industrial plant, prior to institution of a comprehensive program for better voltage control. These curves depict the entire problem of voltage control. The difference in voltage between any two curves at a given time is indicative of the regulation between the two points represented.

Major deflections in the curves illustrate flicker, and show how it was reflected to all points in the system though primarily originating on one long radial feeder. This data adequately explained to management why so much trouble was experienced in getting large motors started on that feeder, and why voltage had to be objectionably high at the source to permit operation at the end of the longest feeder.

The problem of voltage limits is clearly depicted. The desired limits are indicated. The curves show that the voltage exceeded the maximum desirable limit at many points in the system while being entirely too low for good operation at at least one major terminal point.

Thermal Capacity

The two principal criteria for judging the load-carrying adequacy of an electrical device or system are thermal capacity and voltage regulation. The two are not directly related. The most common error made is in judging load-carrying adequacy by thermal capacity alone, ignoring regulation characteristics. For example, selection of cable is too frequently based only on published current-carrying-capacity tables without regard for the effects of cable drops on regulation.

The important thing about motors and other power-consuming devices is that their performance characteristics may undergo radical change when incorrect voltage is applied. Manufacturers commonly guarantee compliance of their apparatus with their published performance curves only within reasonable, but fairly narrow, limits of applied voltage. This is all the manufacturers can do. If the system supply voltage is outside the limits of manufacturers' prescribed tolerances, the performance of motors can differ greatly from the published performance curves. This is the equivalent of having selected the wrong motors.

Regulators

In seeking solutions to voltage control problems, attention is quite naturally drawn to voltage regulators. Many engineers hope that in some mysterious and economical fashion, automatic voltage regulators will remove all of their voltage control problems.

There is a great demand and need for such equipment. Automatic voltage regulators are built that do a spectacular job in electronics, laboratories, instrumentation, and other special applications where cost of control is secondary to precision of control. Unfortunately, such regulating equipment is seldom practical in heavy power distribution.

Precise regulators are not only limited in power-handling capacity, but they usually operate on a principle that throws away from 10 to 30 percent of their input power in order to furnish the constant and steady voltage output. This is tolerable if a small amount of power is being consumed. But few people want to pay for 1,000,000 kwh only to throw away some 200,000 kwh in regulator losses. It would be far cheaper to re-design the system or to modify all the critical apparatus to permit greater voltage tolerance.

Practical voltage control tries to find the best solution for a particular problem within the realm of three general approaches:

¶ Design of the system, or of component parts of a system, to provide proper standards of electrical adequacy and equipment performance.

¶ Application of voltage-compensating regulators and boosters, with either manual or slow-acting automatic control.

¶ Static devices (or their electrical equivalent) for achieving voltage compensation.

Short-Term Economics

The first approach is the one that strikes at the real cause of poor voltage regulation — forcing more power flow through a system than it is designed to handle. But complete re-designed is not always practical. It is no help to advise re-design when the plant engineer does not have the money to re-build an entire system, no matter how well it might amortize over a long term. He may be forced to deal in very short-term economics, and still be faced with the problem of keeping the plant running.

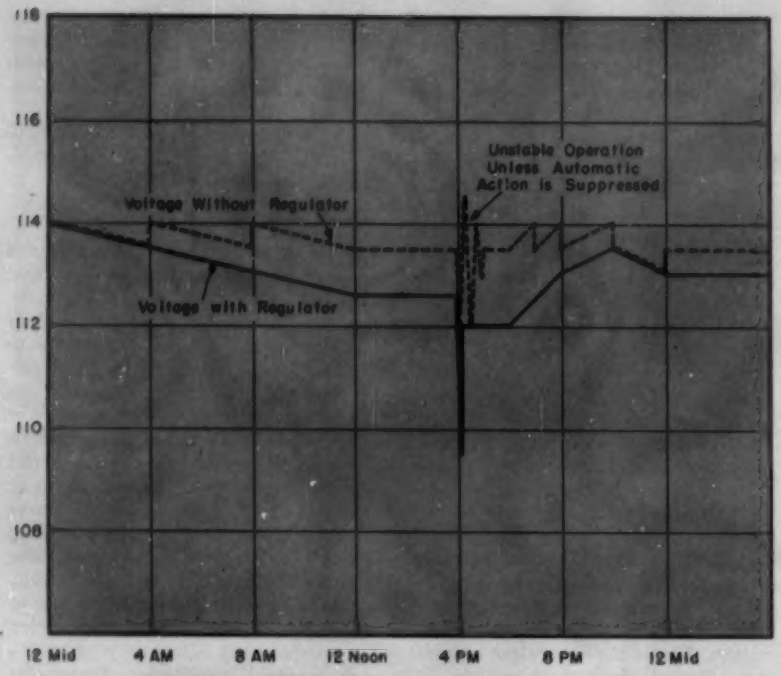
Happily, it is seldom necessary to re-build an entire system in order to satisfactorily alleviate most voltage control problems. Necessary construction can be accomplished without major shut-downs if good planning is used. Division of existing load among new feeders, and establishing loops and networks on the old feeder system frequently can improve regulation and reliability markedly and at reasonable cost.

Re-designing all or part of a system, even if technically advisable, may involve costs that are unwise because of other economic conditions present in the plant. For example, a plant or division whose useful life has nearly expired, but that must be kept running a few more months or years, is a poor place to invest modernization funds.

Provide Regulators

The second approach is that of providing regulators or boosters to control the voltage limits at the load, though effectively allowing poor regulation and excessive line losses to continue as they were. In principle, this amounts to varying the transformer ratios, either by means of adjustable taps on existing transformers or by the insertion of additional low-ratio transformers and auto-transformers as voltage boosters or voltage dividers.

If the problem is primarily one of incorrect voltage limits, where the range of system voltage regulation can otherwise be tolerated, manual tap adjustment or fixed-ratio boosters will sometimes do the job. Most modern power transformers for industrial plants are equipped with taps that can be manually changed



Voltage regulator smooths voltage swings. When swings are rapid, time-delay suppression of regulator action is necessary to prevent unstable operation.

under no-load conditions, but that cannot be changed without interruption of load power.

Power transformers can be purchased equipped for manual or automatic tap changing under load without interruption of service. The control systems for automatic tap changing are sensitive to some aspect of voltage change.

Expensive Solution

Automatic-tap-changing transformers are more expensive than is usually warranted in a system where good regulation is built in during initial design. When load growth expands beyond original expectations, tap-changing-under-load becomes desirable. But it is then almost impossible to modify industrial power transformers from no-load-changing taps to load-changing taps; the cost of replacing the transformer may also be somewhat excessive.

Modern, high-voltage power transformers have fairly high reactance. For this reason they tend to have a little higher percent regulation than low-voltage transformers. If it is known that the utility supply will vary and that the power transformer regulation will compel unreasonable regulation standards for the rest of the plant distribution system, it is well to consider at the start the use of automatic tap changing at the primary power transformer (or at least manual load-changing taps.)

Sensitive Areas

It is quite possible, and sometimes feasible, to apply automatic or manual load-changing taps to load-center transformers. If a plant with several load centers has only one or two areas that require unusually good voltage control, it may be found that the most economical approach is to provide the critical load centers with automatic tap changing, allowing normal (but less rigorous) standards of regulation to apply to the other areas of the plant.

Using automatic tap changing at both the primary power transformer (to compensate for utility variations) plus using automatic tap changing at the load-center transformers (to compensate for plant system regulation) is not as attractive as it might sound. First, the spread between the two criteria of thermal capacity and voltage regulation is not so great that transmission costs could be reduced in proportion to the extra cost of two sets of automatic tap changers in series. Second, automatic tap changers are slow-acting devices; they are able to compensate with complete satisfaction only for slow and gradual changes of voltage. They are inherently inferior in their stabilized regulation to an adequate and properly designed system. To prevent unstable operations worse than the original situation, modern practice finds it necessary to suppress the automatic action by time-delay relays during sudden inrush periods. Under these conditions, it is impossible to correct flicker by setting up two automatic tap changers in series with each other.

Feeder Regulators

Feeder regulators usually consist of variable, tapped auto-transformers with automatic or manual control of tap settings under load. Their power-carrying capacity is somewhat limited in the economic sizes. They perform the same function as tap-changing transformers. They should not be used in initial design where the same function can be performed by regular transformers with load-changing taps. They represent an additional loss in the line that will continue to dissipate core loss as long as they are energized, plus additional copper losses in proportion to the square of the load current.

Feeder regulators have greatest usefulness in alleviating bad conditions on an existing radial line when these conditions must be immediately improved at fairly low cost. They cannot compensate for large motor inrush currents although the automatic mechanism will try to respond unless suppressed by time-delay relaying.

Capacitive Devices

The third approach to voltage control is that of applying capacitive elements to the circuit. Static capacitors can either be applied in shunt or in series, with distinctly different results. Synchronous condensers and synchronous motors are also leading-reactive devices, which can only be applied in shunt.

Shunt capacitors primarily correct low plant power factor from the service entrance to their point of application. In addition, they reduce the total line drop in proportion to the reduction they make in apparent power (kva) flowing in the line.

Because of the way that electrical vectors add, there sometimes is a rise in voltage at the shunt capacitor terminals as load falls off (called reactive rise in voltage). Shunt capacitors, permanently applied, therefore do nothing to improve the voltage regulation. In fact, they have a tendency to make both load regulation and flicker slightly worse, even though power factor is improved substantially. But switching shunt

capacitors on and off in response to load variations does provide a better measure of voltage control although the improvement is not always proportional to the cost of the switching and control.

Rotating Machines

Synchronous motors and synchronous condensers provide the same type of correction as shunt capacitors. Except in very special cases, the improvement to terminal voltage regulation is frequently not enough to justify their installation for regulation purposes alone. But such apparatus can frequently be justified by the power factor improvement they afford.

As with static capacitors, the regulation can only be improved if the leading kvar output of the synchronous machine is adjusted with system load. Although infrequently attempted, this can be done by automatic drives on the field excitation control — the drive being actuated by system voltage, load current, or time-sensitive elements.

Series Capacitors

Series capacitors are not new in principle but are relatively new in power systems applications. A great deal remains to be learned about the practical problems they pose. They have many drawbacks at present, but show great promise of becoming one of the most practical and effective for many applications.

Series capacitors are tricky to apply. Inaccurate calculations or incorrect interpretation of system conditions may result in aggravated conditions rather than improvements. The amount of correction applied is rather critical, and commercially available sizes of capacitors may not always be close enough to the required size to give a worth-while correction. Furthermore, later changes in the system may require corresponding changes in the series capacitors.

Thermal Capacity

Series capacitors must have the thermal capacity to conduct full line current at normal voltages. They can be easily overloaded, though they still must be able to withstand voltage surges on lines subject to transient disturbances. In general, they are unable to carry short-circuit currents and will probably destroy themselves if short circuits occur in series with them on the line. Two points in the circuit are then in need of repair as a result of one line fault.

Attempts to protect series capacitors against short circuits and high voltages have proved fairly expensive, and they are largely unproven or relatively unsatisfactory. Many engineers would feel unable to give more than a lukewarm recommendation to the present protective devices.

Auxiliary Contactors

Some of the protective measures use auxiliary shunt contactors to short the capacitors out until the main breaker has a chance to interrupt a fault. Such contactors themselves cannot always be uniformly and dependably relayed fast enough to give full assurance of capacitor protection.

Self-clearing parallel gaps across the series capacitor are promising but unproven. One of the biggest troubles is cost. Exclusive of expensive series capacitors used on major high-voltage utility transmission lines, the capacitors required for the average plant are relatively inexpensive devices — themselves not worth the cost of much protection. The protective measures are mainly needed to protect the plant's production.

Help Supply Side

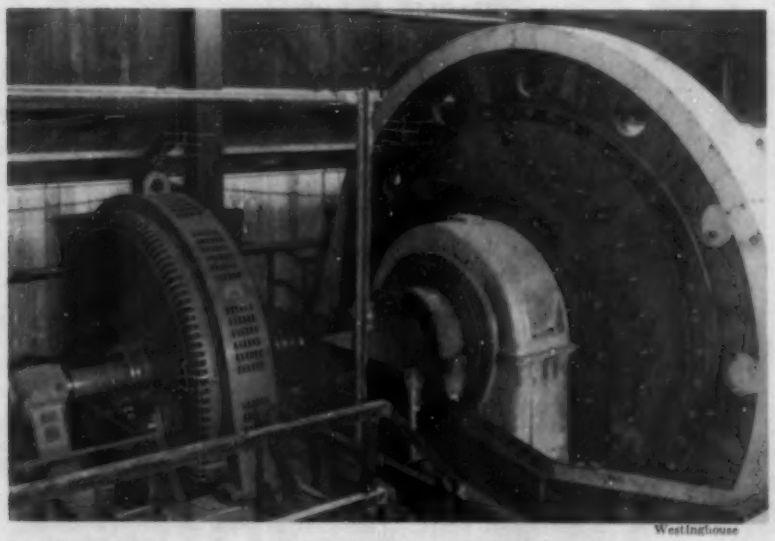
Series capacitors make a slight improvement to the supply side's power factor, but this improvement is not at all comparable to the power factor correction to be derived from the same capacitors if used in shunt with the load. Just as with shunt capacitors, no improvement in power factor on the load side is gained. It is possible that apparent power circulation (kva) may be increased between the load and the series capacitor.

Series capacitors do not reduce the magnitude of inrush currents nor do they reduce the apparent power flow for low power factor loads; they only reduce the total effective line impedance through which these currents flow. Furthermore, full lagging drop is encountered at all points on the line prior to the capacitor, up to and including the input terminal; the compensating voltage rise takes place entirely within the capacitors, and it is available only on the load side of the series capacitor. The line drop on the supply side of the capacitor is the same as if the capacitor had not been added. This means, that for a line with several load taps, a separate set of series capacitors is required for each load, with different values of capacitors for each tap.

As techniques are developed to permit more general use of series capacitors, so that industrial plants will not have to feel they are pioneering in an unproven field, it is expected that some re-evaluation of series capacitors may occur.

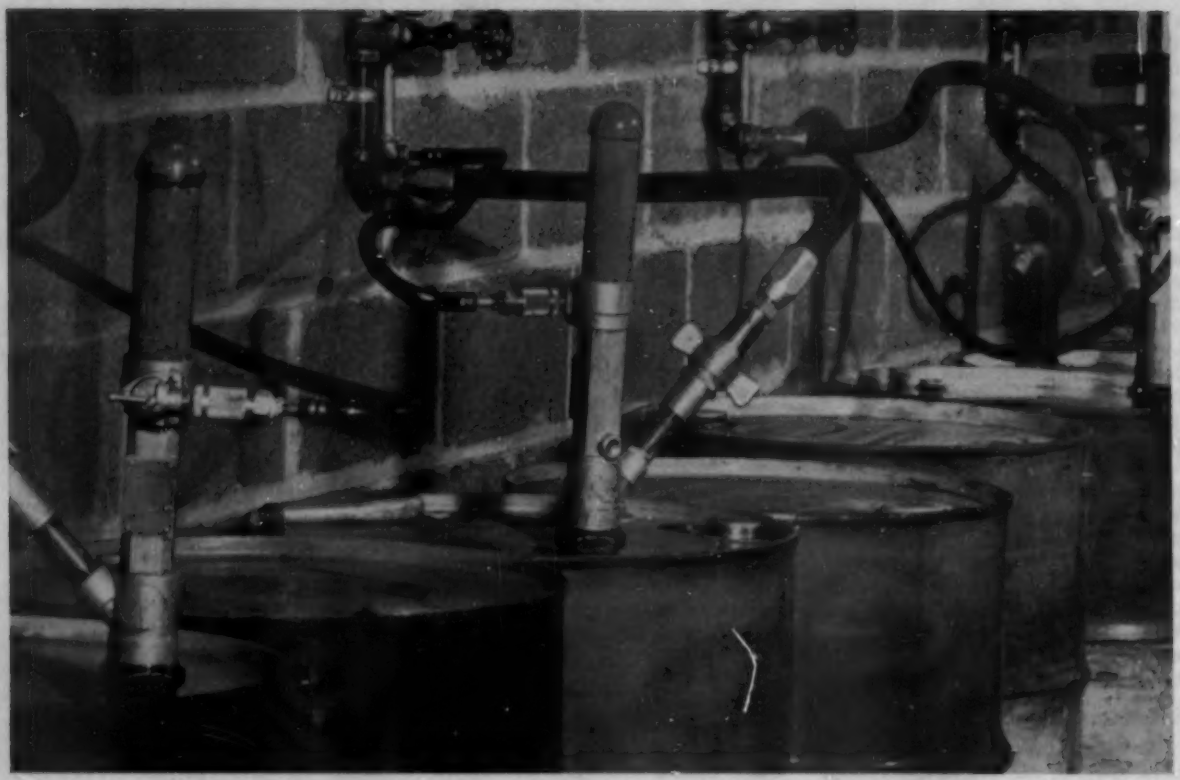
Watch Limits Too

For adequate performance and reasonable life expectancy, electrical devices require that the applied voltage stay within prescribed limits while going through the swings allowed by system regulation. Good regulation is not enough. Keeping the system voltage within limits is equally important.



Westinghouse

Devices for power factor correction can help out in problems of voltage control. Synchronous motors, like this one driving a ball mill, are often used.



Air operated pumps are inserted in the barrel covers to distribute the lubricating oils to a central dispensing panel.

Central Depot Handles Bulk Lubes

I&P EXCLUSIVE

CHARLES L. POPE
Head of Lubrication Section
Kodak Park Plant
Eastman Kodak Company

BEFORE EASTMAN KODAK decided to centralize and control the distribution of bulk lubricating oils and greases used in the equipment located throughout their various departments at Kodak Park, each department would receive its required quota of grease and oil directly from the supplier. Every department, in turn, developed its own method for handling these lubricating supplies. Left to individual discretion, these methods ranged from very good to very poor.

Generally speaking, a number of bad practices became prevalent. Grease guns would be filled directly from open barrels, the grease being scooped out with wooden ladles or spoons. This method was messy and very wasteful of greases. Oftentimes, the barrels would be left standing open, with the contents directly exposed to contamination by metal chips, dirt, and other plant wastes. If critical machine parts are lubricated with a contaminated lubricant, excessive wear and costly damage may result.

When a fresh new can of grease stands available beside an old one, the temptations of the employees to ignore the nearly empty grease barrel are obvious. More likely than not, the almost-empty barrel would be discarded by the men — still containing a quantity of usable grease. Considering the number of barrels used in each department each year, multiplied over a period of years, the grease that was wasted represented a substantial quantity.

To correct these and similar conditions and to exercise better control, Eastman Kodak decided to centralize and set up a uniform system for bulk handling of their oil and grease supplies. A small warehouse building was selected in a location that was both readily accessible by outside transport services — railroad and truck — and at the same time was convenient to most of the Eastman plants in the area.

At the same time, a system was adopted for periodically collecting all the grease guns and oil cans in the various departments and bring-

ing them to the central depot. There they could be filled with oil or grease and then returned to the individual departments. This was also a good opportunity to have the grease guns checked, cleaned, or repaired — if it was found necessary.

The method used to dispense grease is effective and efficient. The four different types of grease are dispensed from their individual barrels by air pressure. Instead of opening the cover of the barrel, a special pneumatic air pump is installed in the cover and a compressed air line is attached. The grease under pressure is dispensed from a filling spout directly into the barrel of the grease gun. Because no manual handling of the grease is involved, there is no mess, waste, or possibility of contaminating the grease in the barrel. The grease guns are marked and returned to the individual departments in compartmented boxes that are identified by department number and plant location.

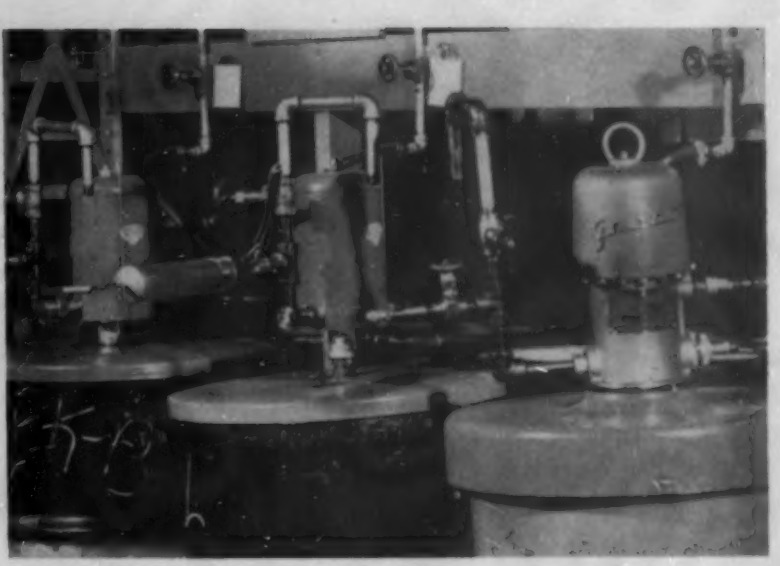
Eastman maintains a stock of fifteen oils which cover the majority of lubricating oil applications. The oil barrels have an air operated pump inserted and connected by pipe to a central dispensing panel. The oil is distributed among the departments in smaller quantity containers according to the individual department requirements. There are also twenty-five lubricants stocked in smaller quantities for special purpose applications.

One attendant can adequately handle the central distribution of the bulk lubricating materials. When not busy actually dispensing greases or oils, he maintains and cleans spare oil cans or grease guns. There is ample storage space for supplies, records, and a roomy working area.

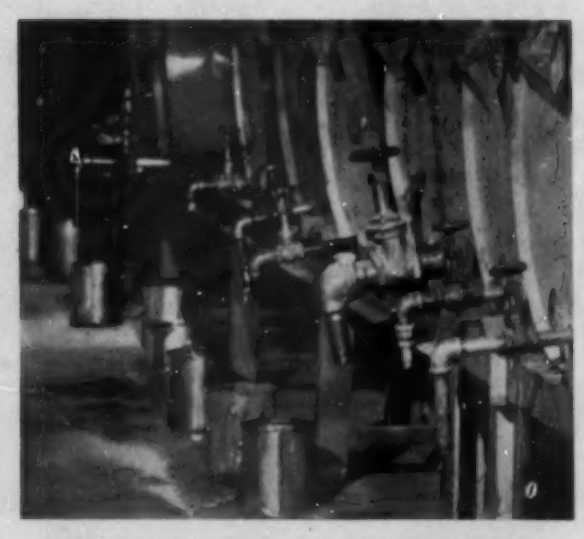
There are many advantages of the central distribution system. It is easier for the supplier to deliver and pick up his barrels. The Lubrication Section of the Eastman organization (and also Accounting and Purchasing) can readily keep an eye on the amount and quality of lubricants being used by the different departments. Waste and contamination of greases has been eliminated.

The departments are satisfied, too, because they no longer have to concern themselves with handling bulky barrels or the repair, cleaning, or filling of grease guns. They send out their empty grease guns or oil containers and within a short time receive them back fully serviced.

The central distribution and handling system has worked out to everyone's satisfaction and has saved Eastman many dollars in actual grease and oil savings, manpower consumed in handling, and good lubrication practice.



To avoid contamination and waste, grease is pumped from the barrels by compressed air operating a special pneumatic air pump installed in the cover. This method makes it unnecessary to ever actually open the grease barrel.



Eastman also stocks about twenty-five lubricants in smaller quantities for special purpose applications.

The dispensing panel for lubricating oils is marked to identify the proper oil for a given application.

Clam shell bucket handled by crane transfers material from storage pits to charging hopper.

Engineered Incineration

Large quantities of burnable waste can be disposed of best in an incinerator. The installation at the National Institutes of Health illustrates modern practice.

I&P EXCLUSIVE

THE PURPOSE of any industrial incinerator is to dispose of useless waste products in the most economical way. At the same time, the flue gases discharged should be as free of solids and odor as possible. Incinerators may be termed a necessary evil — but they are indispensable, and they must be well designed and wisely operated, or the waste they are designed to consume will be spread over the countryside in the form of noxious gas and heavy fly ash.

The National Institutes of Health, in Bethesda, Maryland, has a waste disposal problem corresponding to that of many industries. They expect ultimately to dispose of approximately 96 tons of waste every 24 hours. The incinerators were designed to handle waste containing about 35 percent moisture, 6.5 percent ash, and 58.5 percent combustible—figures fairly typical of refuse from industry. To handle this volume there is installed, alongside the heating plant, an incinerator area in which are located two American Incinerator Company units having Flynn & Emrich stokers equipped with hydraulically powered stoker bars and dumping grates. These incinerators are charged from the top through hydraulically operated doors.

The furnaces are completely lined with fire brick, having no provision for steam generation. Heat is entirely wasted as in any true incinerator. If the moisture content of the waste goes above 50 percent, it is necessary to support combustion by providing additional fuel. This is accomplished through two gas burners of conventional boiler type which are installed on the sides of each furnace. These are designed for electric ignition and are equipped with Wheelco Flame-otrol flame control. Because of the average 35 percent moisture content of the waste at the Institutes, the gas burners are normally used only for starting up.

Each incinerator has its own 46,000 lb per hr Schneible flue gas scrubber. This volume is made up of 42,100 lb of air, 2300 lb of combustible, and 1600 lb of water. The flue gas from the furnace enters these scrubbers at an average temperature of 1200 to 1400 F, goes through five water curtains de-

signed to remove all solids above 2 microns and 70 percent of solids below 2 microns in size, and then leaves the scrubbers at a temperature of 165 F.

Beyond each scrubber is an induced draft fan to provide the necessary draft to pull the gases through the scrubbing process and discharge them out of the stacks.

This arrangement of equipment requires instruments and controls equal in number to those found on the average industrial boiler. Each incinerator has its own panel board located on the operating floor. These boards have on them the flame controls for the gas burners, induced draft fan on-off switches and speed controls, controls for the hydraulic rams operating the charging doors, and two recording pyrometers. An operator stays on this floor at all times when the incinerators are in operation to watch these controls and supervise the charging and burning within the furnace.

Waste Flow

Waste material is delivered to the incinerator in three ways—

¶ Galvanized iron cans are brought to the building on electric mules through a tunnel connecting the incinerator building with several other buildings on the Institutes grounds. These cans are raised to ground level on an automatic lift designed for handling such cans. At ground level they leave the lift and roll onto a roller conveyor leading to an automatic can dumper. The contents are there dumped into a storage pit.

¶ Trucks bring cans from buildings not connected with the incinerator building by underground tunnel, and when unloaded from the trucks, these cans are placed on the roller conveyor leading to the automatic can dumpers.

¶ Waste from distant buildings is also delivered in "Dempster Dumpster" designed trucks that unload directly into a storage pit from the unloading platform. This constitutes bulk unloading into the pits as opposed to can unloading.

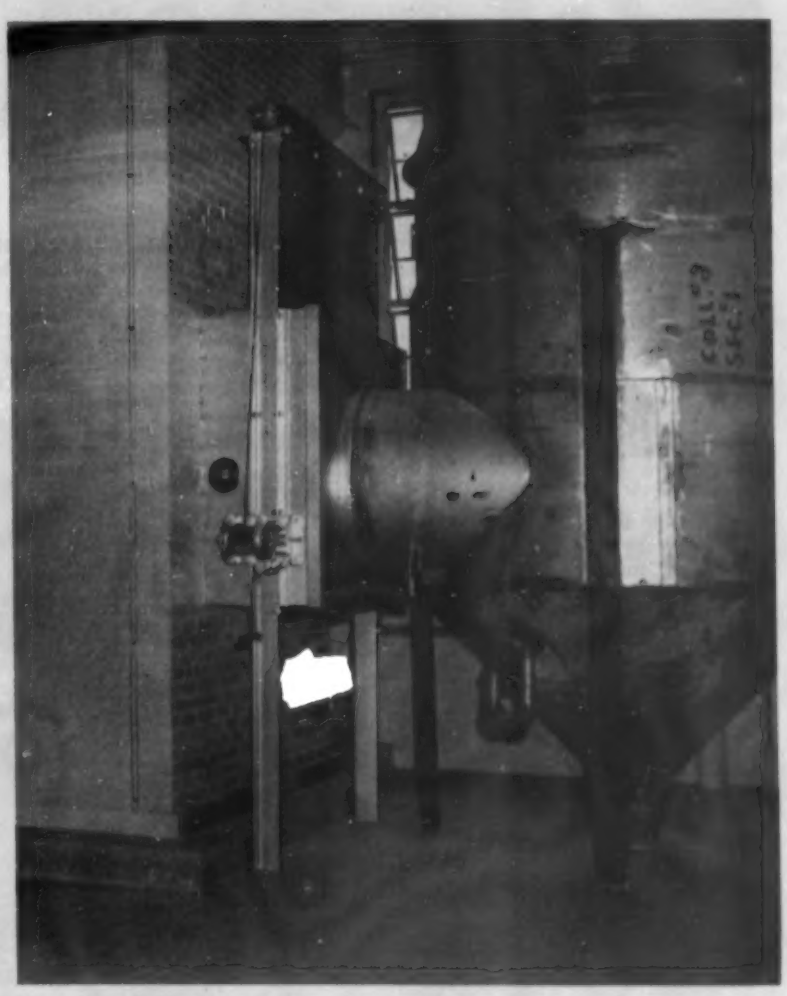
There are two storage pits at this installation. The double pit design was selected with the thought that waste with very high moisture content would be dumped into one pit and the dry materials into another. It was thought that these could be mixed into an easily combustible charge before going to the incinerator. While this might be necessary for some installations, operation at the Institutes has shown that separation is unnecessary for these materials, for these incinerators will take the waste as delivered without consideration of moisture content.

From these storage pits the refuse is picked up in a Blaw-Knox clam shell bucket handled by a 2-ton, Shepard Niles electric crane. The crane operator selects the material from the storage pits, and the clam shell bucket carries it to hoppers above the incinerator charging chutes. When a hopper is full, the crane operator contacts the operator at the firing level through a Vocatron signaling system or an electric bell signal. As firing conditions dictate, the firing level operator actuates the control that puts into operation the hydraulic ram of the charging door below the full hopper. The door slides back to uncover a three foot square charging opening and the waste falls to the furnace grates.

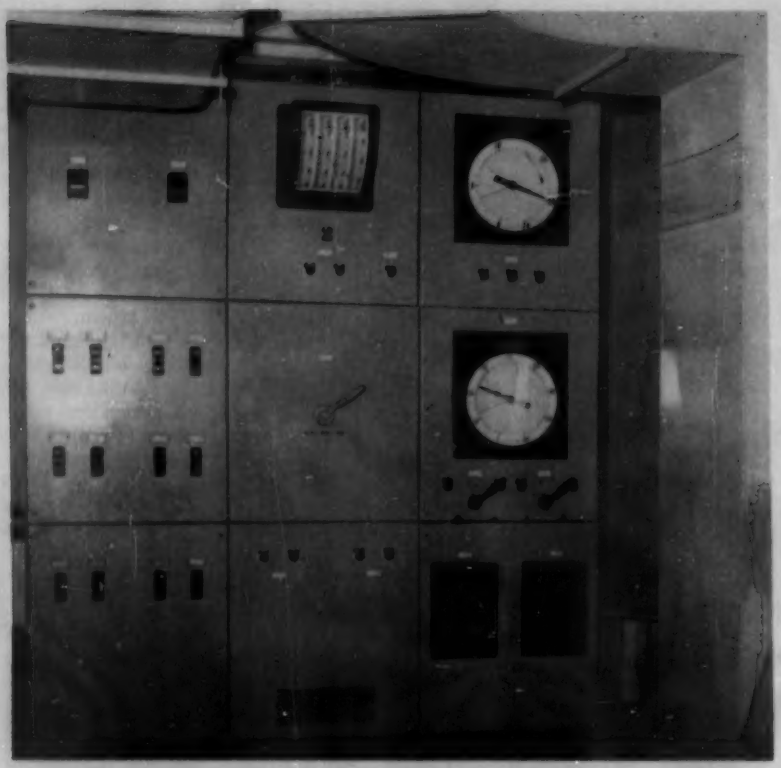
If the furnace is already in operation, the fireman merely has to see that the load burns properly. If this is the first load in the morning, dumped into a cold furnace, the fireman must use a pushbutton to ignite the gas burners to start combustion of the waste. When the gases from the furnace reach normal operating temperature, as shown on the indicating pyrometer, the gas burners are cut off.

Waste charged into the furnace falls on the rear of the grates and is then moved forward through the furnace by the action of the manually selected hydraulically operated stoker grates. When the waste reaches the front of the grates as ash, the hydraulic dumping grates are actuated to drop the ash to the pit below.

There is, quite naturally, a considerable amount of ash. Each morning, before the incinerators are fired, an operator goes to the ash pit and removes large noncombustibles with a rake. These larger items col-



Dust collector cleans flue gases before they are discharged from stack.



Instrument panel includes flame control, induced draft fan control, controls for hydraulic rams on charging doors, two recording pyrometers, and draft gage.

lect on a small grating that sifts them from the fines. The fines pass through the grating and fall into a hopper below. From here they are withdrawn through a Brady ash ejector (vacuum) system and carried through piping to a conventional ash storage silo outside the building. There they are loaded onto trucks and hauled to a dump.

The Gas Cycle

All matter that does not fall out as ash goes into the flue gas. In any incinerator the flue gas is much harder to handle than that from a conventional boiler. The fuel here is not coal, gas, or oil, but a mixture of materials that could hardly be classified as fuel at all. The flue gas produced in an incinerator could never be allowed to go freely out of a stack without danger of contaminating the surrounding countryside.

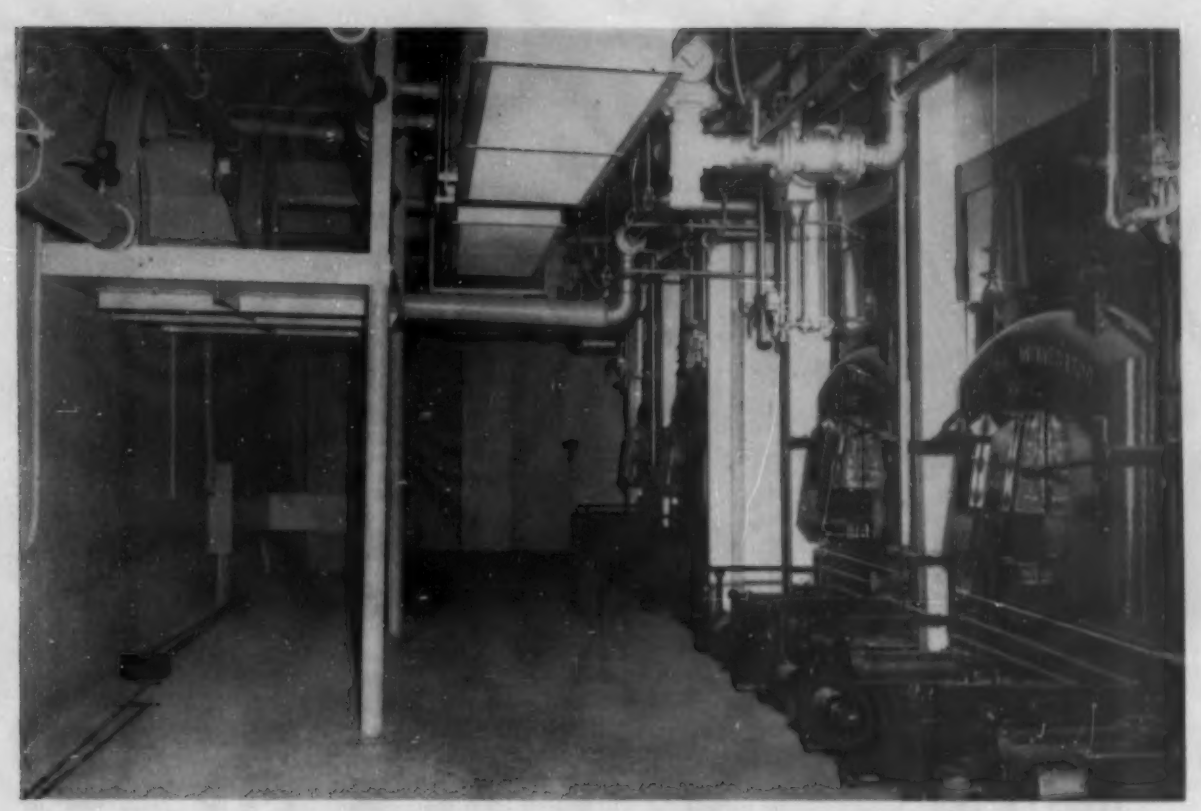
In this incinerator the combustion air is drawn in at the side of the furnace toward the rear. It moves forward toward the combustion chamber through the plenum chambers in the side walls. This arrangement serves to cool the inside furnace walls while the air itself is being preheated.

Gases leaving the furnace go directly to the scrubbers of the dust collector, being drawn on their way by the induced draft fan. In the collector, the solid particles are removed, the gases washed, and the clean gas then goes through the induced draft fan and out the stack. The washing water goes to a settling basin (which is occasionally cleaned of sludge by hand) and then on to the sewer. Since the scrubbers are designed to use 90 gpm of water each, the engineering staff have been considering methods to reuse the water from the settling basin. If this can be done, the savings will be considerable.

One interesting aspect of this installation is the use of automatic controls to regulate the temperature in the furnace. There are two recording pyrometers on each furnace. One records the temperature of the gases leaving the furnace, while the other records the temperature of the gases at the exit from the scrubbers. Since it is known that for proper operation the gases leaving the furnace should not go over 2000 F, the pyrometer in the furnace is tied into the induced draft fan controls so that when that high temperature is reached, the fan is automatically cut off, and a hydraulically operated damper is shifted so as to bypass the scrubber and allow the gases to go out to the stack under natural draft. Very quickly the firing in the furnace responds to this reduced draft, and furnace temperatures drop. Then, the system goes back onto normal operation with exhaust through the scrubbers and the induced draft fan. This set-up keeps the temperatures in the furnace at a safe level for exhaust through the dust collector.

The operation resolves basically

Hydraulic rams, controlled from panel, actuate charging doors of the incinerator.



Front of the incinerators on the firing level. Hydraulic equipment actuates the stoker bars and the damping grates.

to one in which additional heat from gas burners is added under the control of the fireman whenever furnace temperatures are too low, and a switch from induced draft to natural draft is accomplished automatically whenever temperatures are too high, thereby resulting in an immediate drop of temperature to desired operating level.

Maintenance

Firing conditions in an incinerator are, by necessity, far from ideal. Maintenance is a major problem. There is extreme mechanical and thermal shock every time a new charge is dropped on the grate, and there are no water walls to protect the refractory.

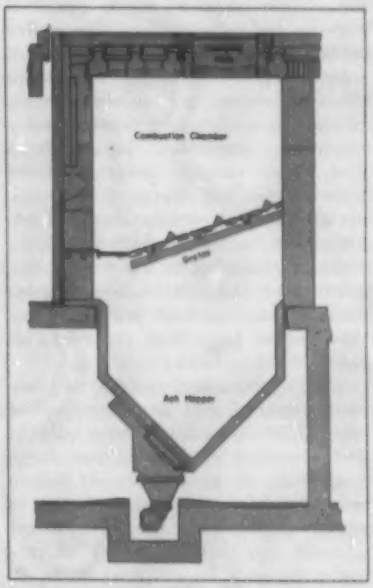
At this installation the refractory linings of the charging doors, the access doors, and the lintels and jams around and above these doors must be replaced periodically by the National Institutes of Health maintenance personnel. The Institute engineers have found it least expensive to cast these parts within the building rather than purchase them in precast form. Since the incinerators at present operate only 10 hours a day, there is time for maintenance work during the down hours. Spalling and breaking of the refractory is to be expected. Repair has been through application of plastic and castable refractory and refractory of special shapes.

Each morning the brickwork is inspected, and repairs are made immediately if needed. This type of maintenance is a part of normal operation of any incinerator, and it cannot be avoided. The Heating Plant Supervisor, A. S. Lowey, feels that maintenance requirements of this installation are at a minimum for the type of waste being burned.

Good Installation

These incinerators are well worth the study of anyone facing the problem of disposal of large quantities of laboratory industrial waste of combustible nature.

There are a few large incinerators in the country making use of the waste heat to produce steam. However, maintenance in a furnace burning waste can cost more than the value of the steam produced. Furthermore, combustion within a waste burning furnace is not as constant or as good as is required to assure a steady supply of steam. These handicaps have worked against the production of steam in most incinerators. It is generally thought better to simply burn industrial wastes — and produce steam in a conventional boiler with one of the accepted fuels.



Drawing of incinerator combustion chamber showing grate arrangement and ash collection system.

Closed type waste heat reclaimers, such as this wall mounted unit, appreciably reduce the over-all costs of operation.

Reclaim Your Waste Heat

I&P EXCLUSIVE

JAMES J. COLEMAN,
Chief Engineer
Laundry and Textile Division
The Patterson-Kelley Co., Inc.

DID YOU EVER take time out to inspect your plant and look for visible signs of waste heat? It may be flash steam from the boiler return system or exhaust steam from engines, pumps, or steam chests, blowing to the atmosphere. It may be wash water from laundry machines, expended liquor from dye vats, caustic solution from bleacheries, hot water from canneries, or hot waste liquid from numerous other industrial processes, discharging to the sewer. Regardless of the source, such wastes usually retain a high percentage of their initial heat and represent an appreciable expense.

With current fuel costs it will pay plant owners and engineers to be waste-heat conscious, especially if their process operations use large quantities of hot water. If waste heat can be harnessed and put to work, preheating the incoming process water, the over-all operating costs may be reduced 30 to 60 percent, or 30 to 60 percent more output might be obtained for the same cost. The total heat that can be transferred will depend upon the temperature and quantity of hot waste available, but the potential savings are substantial.

Savings

Each 10 F increase in the temperature of one gallon of incoming water per hour represents an absorption of 83.3 Btu from the hot waste. This means that for every 1000 gph of fresh water raised 50 F, 416,666 Btu are reclaimed. At normal industrial pressures these heat units are equivalent to about 473 lb of steam per hour, indicating a possible savings of approximately 13.7 boiler horsepower. Actually the 50 F temperature rise selected for illustration is very conservative. Initial temperature of the incoming cold water has been increased 100 F in some applications.

These values, however, can be used to determine savings for specific conditions. First multiply the total hot water requirements in thousands of gallons per hour by the Btu heat recovery per gallon for the total temperature rise. Then, to calculate dollar and cents savings use the formula:

$$\frac{\text{Btu reclaimed} \times \text{cost per ton of fuel}}{\text{Btu per lb of fuel} \times 2000 \times \text{boiler eff}}$$

Generally the results will show that a waste heat reclaimer will pay for itself in three months to two years. If equipment can be amortized in two years and its construction indicates a life of 20 or more years, the actual profit on the investment would be in the order of 1000 percent. This applies to both of the two basic types of heat reclaimers: the closed type or shell and tube heat exchanger, installed above the floor; and the standard open pit design, consisting of a large heating element submerged in a pit below the floor through which fresh water flows and picks up heat from waste water held in storage.

Closed Type Reclaimers

Shells, or the fresh water sides of closed type reclaimers, usually are constructed of flange quality steel plate. Longitudinal baffles are welded to the interior surfaces of the shell forming four separate water-tight passes, arranged to control the waste water velocity. All exposed shell surfaces in contact with the fresh water are coated with a rust resistant coating during fabrication. The shells also can be made of stainless steel, copper, copper silicon alloy, or Monel metal, depending upon the service.

Heating surface consists of 1¼-in. OD, #16 BWG, seamless drawn, straight copper tubes, supported throughout their entire length by heavy transverse baffles, which also control the fresh water velocity.

Tube ends are roller expanded into heavy, flange-steel tube sheets at each end, and are arranged so the waste water velocity is controlled at all times. The tube sheets are welded integrally to the water chambers and steel shell.

Waste water chambers also are constructed of flange steel. Hinged water chamber doors, equipped with hinged swing bolts, are provided at each end of the reclaimer to facilitate cleaning and inspection. Open doors give complete access to the interior of the waste water chamber and the full length of the copper tube heating surface. Doors can be opened for inspection of the largest unit in a few minutes, and cleaning can be carried out in less than an hour.

In operation, the fresh water enters the cold water inlet connection at the bottom of the shell, surrounds the heating surface, and flows longitudinally to the opposite end of shell. It then rises to the next shell pass, contacting a hotter layer of tube surface. After making four separate passes through the shell and the final or top pass has been completed, the heated fresh water is discharged to the hot water heater. Meanwhile, hot waste water is pumped from a screened sump or collecting pit to the waste water inlet of the reclaimer, through the four or more tube passes, and then discharged from the waste water outlet to the sewer.

This arrangement offers many advantages. Both the waste and fresh water velocities are constantly controlled, and the fluids flow in opposite directions and through equitable strata of temperature. Maximum heat transfer is obtained with minimum build-up of head pressure on the pump. The complete unit requires very little space and can be mounted on the floor on piers, hung from the ceiling, or set on wall brackets depending upon the project conditions. Connection to the waste and water lines is a simple matter.

Open Pit Reclaimers

Standard open pit type waste heat reclaimers have a cast iron, fresh water chamber that is divided into ten or more passes, designed to control the velocity of the fresh water passing through the unit. This water chamber is gasketed and securely bolted to a heavy rolled-steel tube sheet. In a typical unit the heating surface is 1¼-in. OD, #16 BWG, U-shaped copper tubes, roller expanded into holes — protected by copper ferrules to eliminate possible abrasion of the tube walls—drilled in the tube sheet. Tubes are spaced 2¾-in. center to center in horizontal rows and 2-in. center to center in vertical rows using rectangular pitch, and are securely held by heavy supports.

This assembly is submerged in a suitable pit, usually built of concrete and recessed below floor or ground level. One end of the pit is devoted to a screened inlet basin, while the opposite end contains a baffled overflow passage. The reclaimer is placed in the center section, which should be as free of baffles and obstructions as possible and should have sufficient clearance between the walls of the pit and the reclaimer tubes to facilitate cleaning and inspection of the unit. The 1½-in. through clearance between tube walls in the horizontal rows allows for free settling of sludge or heavy particles in suspension in the waste water.

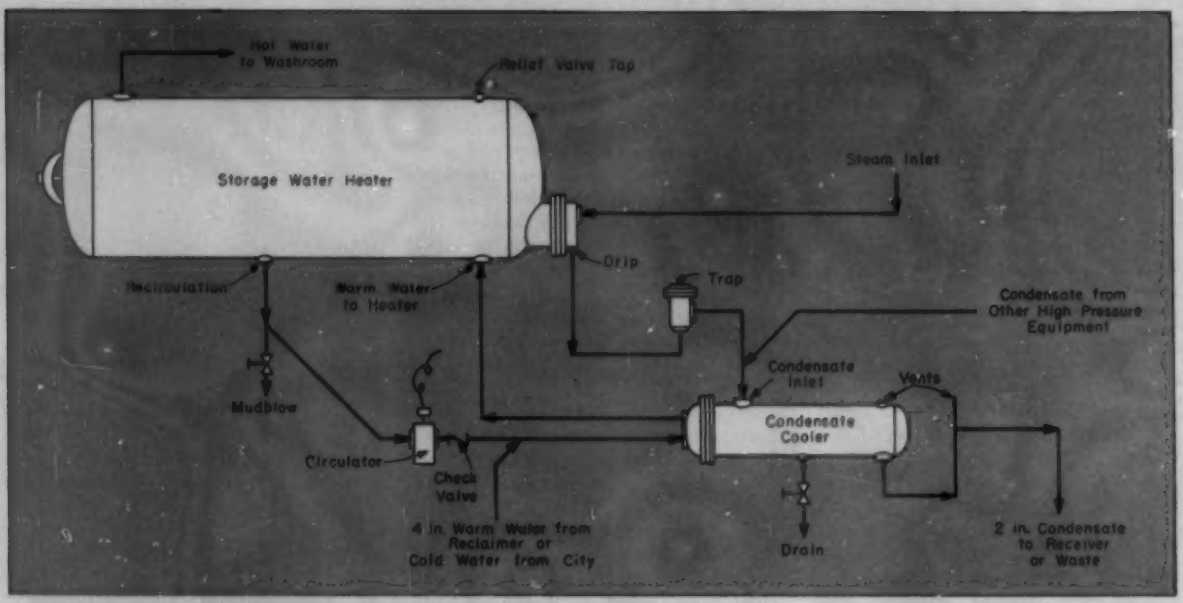
Photo shows a typical installation of an open pit type waste heat reclaimer.

Soiled waste enters at the inlet basin, and when the level reaches a certain point, it passes through the screen and discharges into the main pit. Upon entering the main pit, the waste water stratifies—the hottest water rising to the top and the cold water settling to the bottom. The overflow section of the pit usually is baffled from the pit proper, so that only the coldest waste water is displaced under the baffle and discharged to the sewer. The hot water is retained in the pit in strata averaging from 165 to 70 F. Fresh cold water enters the reclaimer at the bottom of the fresh water chamber, rises through the unit, and discharges, after making its last pass, to a storage heater.

Installation Procedures

Both the closed type waste water heat reclaimer and the open pit reclaimer have their particular advantages and applications. Equal

Hinged doors facilitate maintenance and inspection of shell and tube units.



This schematic flow diagram shows the recommended arrangement of piping for a typical condensate cooler installation.

benefits and savings can be obtained from either type although the ease of locating and of cleaning the closed design usually makes it more attractive. The installation procedure, however, is generally similar for both types.

¶ Break the sewer line at a convenient location between the last machine discharging hot waste and the exit from the building.

¶ Construct a sump pit at this point to collect the hot wastes.

¶ Pump the hot waste water from the sump through a closed type reclaimer or submerge an open pit type reclaimer in the hot solution. Pit size, of course, will depend upon the type of reclaimer used, as well as the hot water demand.

¶ Connect the cold, fresh water supply line to the reclaimer and the warm water outlet from the reclaimer to the storage heater.

Removing Solids

Frequently waste waters are fouled with lint, tape, pieces of material, refuse from processing of foods, or other debris too numerous to mention. To keep equipment free of such materials, reclaimers usually are furnished with a screening device that sets into a gutter adjacent to the sump pit. These screen boxes—constructed with a series of removable strainers of varying sizes to minimize maintenance—remove the majority of the solids.

As a further guarantee, an additional self-cleaning type, revolving screen may be installed in the sump pit. This unit is essentially a perforated steel cylinder with an open top and enclosed bottom, and usually is placed in a vertical position, 60 percent submerged in the waste water. The 40 percent above the water line takes care of intermittent surges so that the screening device is not flooded with waste. Piping for the pump extends into the cylinder from the top to a point well below the water level.

Revolving screens are designed so the assembly can be bolted to the side of the pit with the gearhead driving motor above the floor level. The unit revolves at a given rate of speed, creating a centrifugal force sufficient to keep the outside surface of the cylinder free from solids accumulation. A stainless steel knife blade adjacent to the revolving cylinder assures a clean surface by scraping or cutting off debris that may tend to adhere to

Engineer examines the gear motor drive on a self-cleaning, revolving screen.

the sides because of pump suction.

Reports from one plant illustrate the effectiveness of the revolving screen. Before installation, the waste water side of the reclaimer was cleaned once a week, and accumulation amounting to one 10-quart pail of lint was removed from the waste water chambers at each end. Six months after installing a revolving screen there was no trace of lint when the reclaimer doors were opened for inspection.

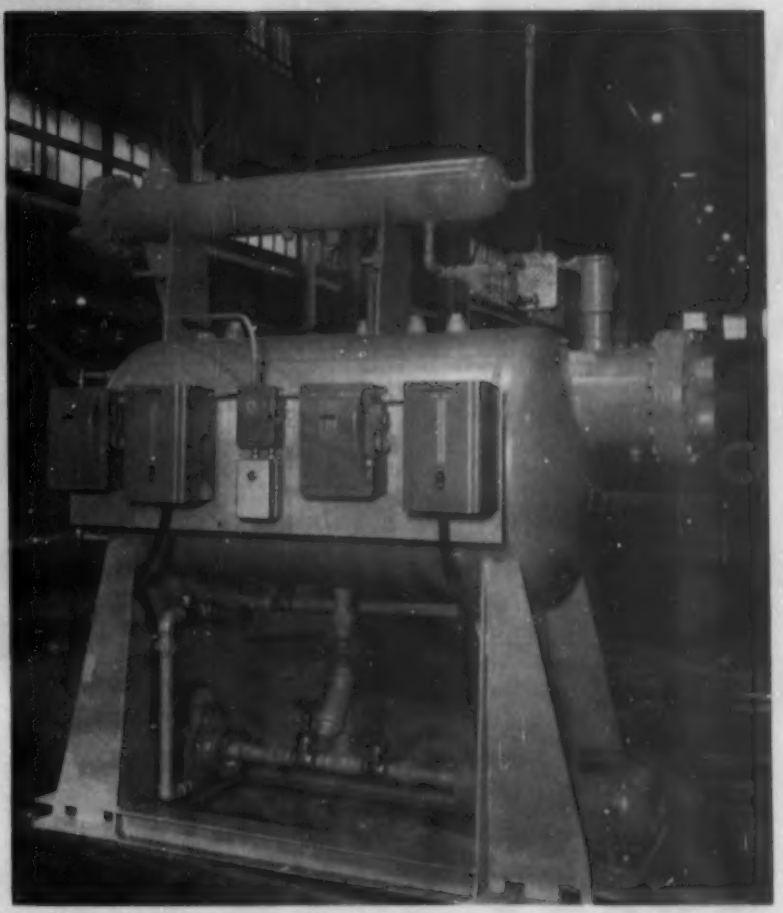
Preventing Atmospheric Losses

Condensate return systems frequently are the cause of substantial waste heat losses. Normally, condensed steam is discharged from process equipment and piped to the condensate receiving tank in the boiler room. If this tank is vented, it would be at atmospheric pressure or O psig, and the temperature of the condensate would be 212 F maximum. Any discharge to the tank over 212 F would flash into steam and pass through the vent to the atmosphere.

If a machine—for example, a flat work ironer in a laundry—operates on high pressure steam at 100 psig and 337 F, and the condensate is discharged to an atmospheric receiving tank at operating temperature, each pound of steam flashed off will carry 125 Btu through the tank's vent. Conditions will be further aggravated if the steam traps located in high pressure lines at the machine are not functioning properly. Traps are supposed to retain the steam in the machine until condensed, at which point, its latent heat is released. If they discharge uncondensed steam, it will blow directly through the receiver vent.

Numerous types of equipment for reclaiming these heat units are available. Their purpose is to cool the condensate from high pressure processes to a temperature below the flash point before it enters the receiver. Designs range from the simple heat exchanger to the complete boiler return system, which also uses heat exchangers as part of the setup. Most units are shell and tube heat exchangers (condensate coolers) placed in the condensate line, or vent condensers located in the vent line from the receiver.

If the existing return system is operating satisfactorily and the only problems are to reclaim the heat discharging from the vent and to cool the condensate sufficiently so that the pumps do not vapor lock, a condensate cooler is probably the answer. Its cost is relatively small, and it effectively recovers waste heat units. If the complete system is troublesome, however, a combination packaged boiler return system may be required. This, of course, will be considerably more expensive.



Packaged, combination boiler return systems are completely factory assembled.

With the typical condensate cooler layout shown in the drawing, all high pressure condensate is discharged to the shell of the cooler. Process water flows through U-shaped copper tubes that fill the shell, usually picking up an average of 30 or more degrees by contact, depending upon the quantity of water passed and the amount of condensate available. The circulating pump guarantees continuous heat transfer when there is no demand for hot process water.

In the complete boiler return system, the condensate cooler is an integral part of the receiving tank, and its construction is the same as the individual unit. All high pressure condensate enters through the connection to the shell on the extending nozzle. It discharges directly to the inside of the receiver.

Process water flows through the tubes in like manner and is piped to the hot water storage heater. The closed feedwater heater on top of the receiving tank can elevate the temperature of the boiler water from 200 F to near steaming temperature using live steam supplied directly from the boiler. Chief purpose of this heater is to relieve the stresses usually prevalent when lower temperature feedwater is employed, improve steaming qualities, and smooth out boiler operation generally. Fuel savings would amount to approximately one percent for each 10 F rise in temperature.

Combination boiler return systems come completely packaged, ready for setting in place in the boiler room. They include boiler feed pumps, condensate receiver, feedwater heater, condensate cooler, and all necessary accessories and controls. Piping and power connections are all that is required before starting operation.

Coal Dust... Stopped Before It Starts—

I&P EXCLUSIVE

STAFF REPORT

Proportioning equipment in the Hiram Walker plant is in the cabinet behind the operator. The permanent fill pipe to the storage drum facilitates the handling of wetting compound.

MANY PLANTS in widely separated sections of the country encounter similar industrial problems—and independently arrive at the same solution with minor variations. For example the large, new, Du Pont synthetic textile fiber plant, near Kinston, N. C.; the Hiram Walker distillery, in Peoria, Ill.; and the International Harvester truck plant, in Fort Wayne, Ind. all experienced difficulties with excessive dust at various points in their coal handling systems. Each solved the problem in the same way—spray application of water containing a small, controlled quantity of soluble surface active wetting compound that reduces the surface tension of the water to a point where it effectively allays dust without increasing the moisture content beyond normal tolerances.

Dust Problems . . . At Du Pont

Equipment for the production of "Dacron" polyester fiber in the Du Pont plant is supplied with steam from two, 138,000 lb per hr, Babcock & Wilcox boilers fired by Detroit spreader stokers. This is one of the many, new outdoor installations to have gone into service in the past few years, only the turbine room, engine room, and control room being enclosed. Outdoor designs offer many savings in construction and maintenance costs, but the advantages planned can be offset by bad housekeeping conditions resulting from coal dust rising from every coal handling step.

At a new plant such as the Du Pont plant, in Kinston, the management and operating personnel are understandably interested in housekeeping. Their opposition to clouds of coal dust further extends to an interest in operating conditions and safety. Coal dust was so heavy that it filled the air in the area around the entrance to the belt conveyor, making it impossible to work in that vicinity for more than a few minutes without a respirator. In the coal storage yard, the bulldozer operator wore a respirator constantly, while in the high voltage switchgear room (the plant generates all of its own power) coal dust settled on the bus bars and breakers to such an extent that the engineers felt that a spark might set off a serious explosion.

. . . At Hiram Walker

Conditions at Hiram Walker were equally troublesome. Housekeeping around a food industry is an extremely important consideration in the maintenance of product quality. Hiram Walker also features inspection tours for the public and naturally wishes to make a good impression.

Steam requirements are supplied by one, 200,000 and two, 150,000 lb per hr Babcock & Wilcox boilers fired by B&W and Kennedy Van Saun pulverizers. The coal handling system includes a separate crusher house, and the equipment is enclosed except at the initial unloading point above the track hopper and between the crusher house and the boiler plant. While this arrangement partially confines the dust to specific areas, it does, in a measure, accentuate the severity of the problem. The explosiveness of any coal depends on its rank—in particular the volatile matter, ash, and moisture contents; particle size distribution; and other factors. With the grade of coal at Hiram Walker spontaneous combustion was of great concern.

. . . At International Harvester

International Harvester currently has four steam generating units in service: two, 40,000 lb per hr Edge Moor boilers with Westinghouse underfeed stokers; one, 50,000 lb per hr Springfield boiler with Westinghouse underfeed stoker; and one, 60,000 lb per hr Springfield boiler with Laclede chain grate stoker. In addition, two small units were removed recently and are now being replaced by a new, 125,000 lb per hr Erie City boiler with Laclede chain grate stoker.

With the exception of the unloading trestle and outdoor storage area, the coal handling equipment is completely within the boiler plant structure. Dust was a serious nuisance at the discharge from the track hopper to a distribution pan serving a flight conveyor, at the crusher, and in the overhead, 500-ton bunker. House-

keeping was difficult, and the dusty conditions had an adverse effect on operation and maintenance.

Independently, the engineers at each plant set to work to find some way to minimize their dust hazards.

Coal Handling . . . At Du Pont

The engineers at Du Pont considered sacrificing part of the cost advantage they had gained in building an outdoor plant by going to the trouble and expense of partially enclosing it. That, despite its cost, would have been only a partial solution. It would have done nothing to alleviate the extremely poor operating conditions for the bulldozer operator and the maintenance crews who had to work around the coal handling equipment.

At this plant, West Virginia and Kentucky coal (1¼-in. nut and slack with 30 to 50 percent fines) is delivered in rail cars that are spotted above a track hopper. A Hewitt-Robins car shakeout loosens the coal so that it falls through the tracks into this hopper, where an oscillating feeder transfers it onto a conveyor belt running from the underground level up to about 12 ft above ground. At this point the coal drops either into a crusher or into a bypass if it is of a suitable firing size.

From the crusher or bypass the coal falls to the base of a bucket elevator that lifts it to a horizontal conveyor belt extending the length of the bunkers above the boilers. When these bunkers are full, the coal is discharged from the top of the bucket elevators to a chute leading to the coal storage yard, where it is spread and compacted by a bulldozer. The conveyor system has a design capacity of 100 tons per hour.

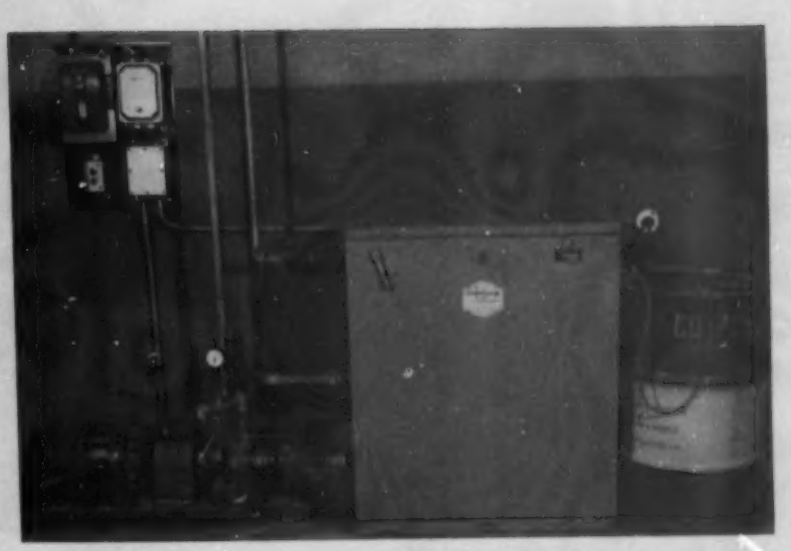
. . . At Hiram Walker

Hiram Walker is extremely fortunate in having an excellent coal supply source (Fulton County, Illinois) within 40 miles of their plant. The coal is high quality, as evidenced from the following analysis based on samples from 33 cars received on random selection dates and representing an average for 112 cars unloaded during August 1954.

Sulfur	2.3
Ash	5.8
Ash (dry basis)	6.9
Moisture	16.4
Heating value, Btu per lb	
As received	11,155
Dry basis	13,345
Moisture and ash free	14,334

Because of the close proximity of the mine, shipments can be scheduled so that the supply and consumption remain in balance without the benefit of outdoor storage. The overhead bunker has an 1800 tons storage capacity or, under normal conditions, approximately 4 days supply.

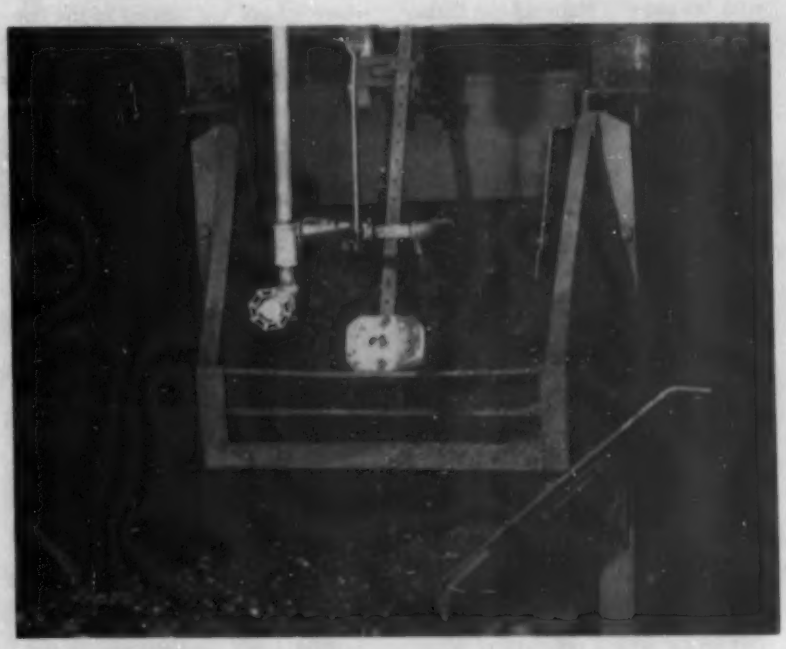
When deliveries arrive they are unloaded over a track hopper in the yard with the aid of a National car shaker. A belt conveyor carries the coal from an oscillating feeder under the track hopper to a crusher which in turn discharges onto a belt conveyor that runs up to and across the bunker in the boiler room. The system handles approximately 85 tons per hour. As a precaution against any emergency, Hiram Walker maintains a reserve outdoor storage of 10,000 tons at another one of their plants in the vicinity.



International Harvester has the solenoid valves in the solution lines wired into the conveyor motor control circuit; starts and stops the pump manually.

. . . At International Harvester

International Harvester finds their most advantageous arrangement is to buy coal from mines near the



Initial application point for wetting compound at Hiram Walker is where the shaker beneath the track hopper discharges the coal onto the belt conveyor.

Du Pont sprays rail cars with a solution containing Johnson-March Compound M-R when unloading coal.

Nozzles over belt conveyors in Du Pont's plant operate automatically from microswitch levers under the belts.

Indiana-Illinois state line. This fuel consists of washed screenings, ranging in size from 1¼ in. to dust, of the following approximate analysis:

Fixed carbon	41.59
Volatile matter	44.48
Moisture as received	4.58
Ash	9.35
Sulfur	3.56
Btu per lb	10,966

Consumption averages approximately 150 to 200 tons per day depending on seasonal variations in the demand.

Coal unloaded into a track hopper with the aid of a National car shaker falls to a distribution plate and is picked up by a flight conveyor running to a coal crusher or crusher bypass depending upon size. From this point, the coal moves through a Simplex loader into a 60-cu ft skip bucket; up a skip hoist tower and into a hopper; from which it is distributed throughout the overhead bunker by means of a distributing belt with plows. The system has a design capacity of about 50 tons per hr.

Dust Control Systems . . .

Faced with comparable coal dust problems, the three engineering staffs independently concluded that the answer might be found in a system using a wetting compound to reduce the incidence of coal dust rather than in some attempt to confine the dust or remove it after it had formed. Each found the solution in the Johnson-March system of dust control.

Basically this method involves spraying the coal at locations where dust forms with a solution of water mixed with a small amount of surface active compound, commercially known as Compound M-R. In designing the system, the application points are selected first, based on careful engineering study of the project conditions. Then the number, size, capacity, and proper placement of individual nozzles are determined for each location.

. . . At Du Pont

At the Du Pont plant, four push-button operated sprays are placed above the rail car for wetting the coal before the shakeout is started. Eleven more sprays are located in the hopper below the tracks, and these are turned on as soon as the car hopper doors are opened. They are cut off when the track hopper is full.

Two more sprays are located on each side of the oscillating feeder between the track hopper and the conveyor belt, and one more spray is centered over the point where the coal falls on the belt. This spray is automatic. When there is coal on the belt, the weight of the coal depresses a microswitch lever pressed against the underside of the belt to actuate a solenoid valve in the line to the spray. If there is no coal on the belt, whether the belt is running or not, the valve remains closed. This automatic shutoff keeps the belt from being wetted when unloaded.

Two more sprays, similarly actuated, are located at the belt discharge where the coal falls to the bucket elevator hopper. Operating experience has indicated that these sprays are needed only with the dustiest coals, so they are shut off by hand valve for normal operation.

The liquid being sprayed comes from an electric motor driven pump installed as part of a proportioning system. The water comes from the regular supply mains, and the wetting compound from a drum located beside the proportioning unit. The feed can be regulated to give any desired mix. At Du Pont, a ratio of 750 to 1 (water to surface active compound) is used.

. . . At Hiram Walker

Hiram Walker does not find it necessary to use outdoor sprays where the cars are unloaded. Adequate results are obtained by introducing solution at three points — where the shaker beneath the track hopper transfers coal to the belt conveyor, above the coal crusher itself, and where the coal falls from the crusher onto the long belt conveyor running to the bunkers. Two nozzles are installed at each location. Operation is fully automatic, the solenoid valves in the solution lines being actuated when a microswitch lever, installed beneath the conveyor belt, is depressed by the weight of the coal.

The proportioning equipment is located adjacent to the coal handling system. Water comes from the company's wells and the wetting compound is stored in a drum next to the pumping assembly. The pump is equipped with a relief valve to recirculate solution to a liquid tank, equipped with float control valve to provide compensation for varying demands. Proportioning control is furnished by an ejector type unit that draws wetting compound from the storage drum in accordance with the flow rate in the water line. The stor-

age drum is equipped with a sensing element to shut down the equipment if the wetting compound level drops below a predetermined point.

One unique feature of the Hiram Walker installation is the use of the surface active compound to prevent slippage of the main belt conveyor between the coal crusher and the bunker. This conveyor is 400-ft long, and previously difficulties were encountered with fine particles of coal collecting on the underside of the belt and causing slippage as it passed over the head pulley. The condition was severe enough to stop the system upon occasion. A weighted gravity takeup was installed that afforded partial relief but did not correct the problem. Finally, three sprays were placed over the gravity takeup pulley and a small amount of wetting compound was sprayed on the underside of the belt. Now the belt remains clean, and slippage is no problem.

. . . At International Harvester

At the International Harvester plant two application locations—two nozzles over the distribution pan beneath the track hopper and four nozzles over the skip bucket below the crusher — provide effective results. The layout of the proportioning equipment is essentially similar to the other two installations except that the solenoid valves in the solution lines are wired into the conveyor motor control circuit. This arrangement has proven entirely satisfactory. The pump at the proportioning unit is started and stopped manually coincidentally with operation of the conveying system.

A cabinet assembly installed in the boiler house basement contains the flow-compensating level tank with float control, proportioning ejector, inlet water strainer, and plastic tubing for the surface active compound. Drums of compound M-R solution are stored on one side of the unit, and the pump and electrical controls are placed on the other side. The entire arrangement is compact, easy to maintain, and readily accessible for the coal handling system operator.

Costs . . . At All Three Plants

Cost figures on any new method are of utmost interest. First there is the capital expenditure for the original installation — the spray heads, controls, piping, pumps, and proportioning equipment. With Johnson-March dust control, this cost includes engineering and design of the system, supervision of erection, operating instructions, and service. Each plant supplies its own labor. The Du Pont installation (20 spray heads) cost $5600 for equipment and $3000 for labor, an over-all cost of $8600. Operating costs have been extremely low. For a period from May 15 to Sept. 24, the cost of the wetting compound, water, electricity for the pump, and freight on the wetting compound amounted to $362, or a total cost of 1.52¢ per ton (23,950 tons).

Figures on the other two installations are comparable. Hiram Walker's three location (6 nozzle) system was installed for about $3500. Company wells supply the service water, and noncondensing turbines provide by-product power to run the pump. The wetting compound is closely controlled to a consumption of about one gallon for each 375 tons of coal treated, bringing the total operating cost to slightly under one cent per ton. As a further guide to cost control a calibrated rule has been prepared so the level of the wetting compound in the storage tank can be checked and the consumption can be calculated in terms of the total coal handled during any particular period.

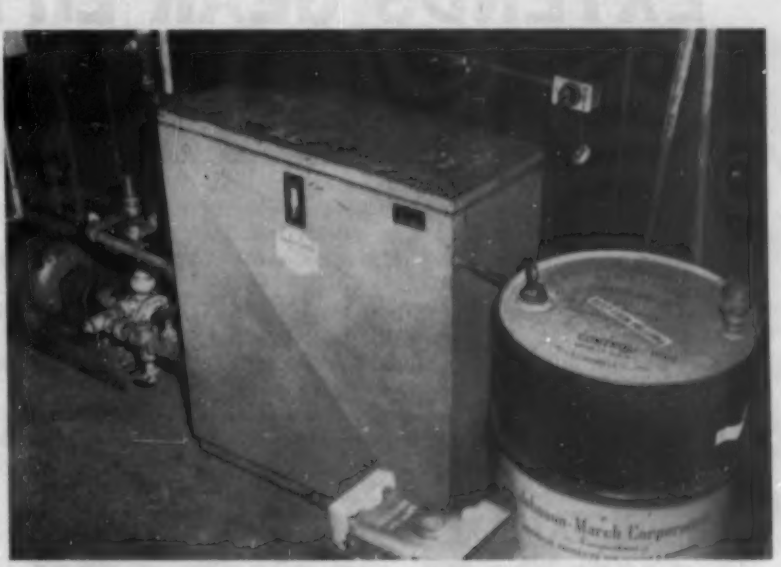
With only two spray locations (6 nozzles) International Harvester was able to install the complete dust control system for less than $3000. Wetting compound consumption for a given coal tonnage is the same as the other installations, but water supply is from the city mains and the plant operates on utility company power. Total operating costs of the service average about 1½ cents per ton.

Results . . . At All Three Plants

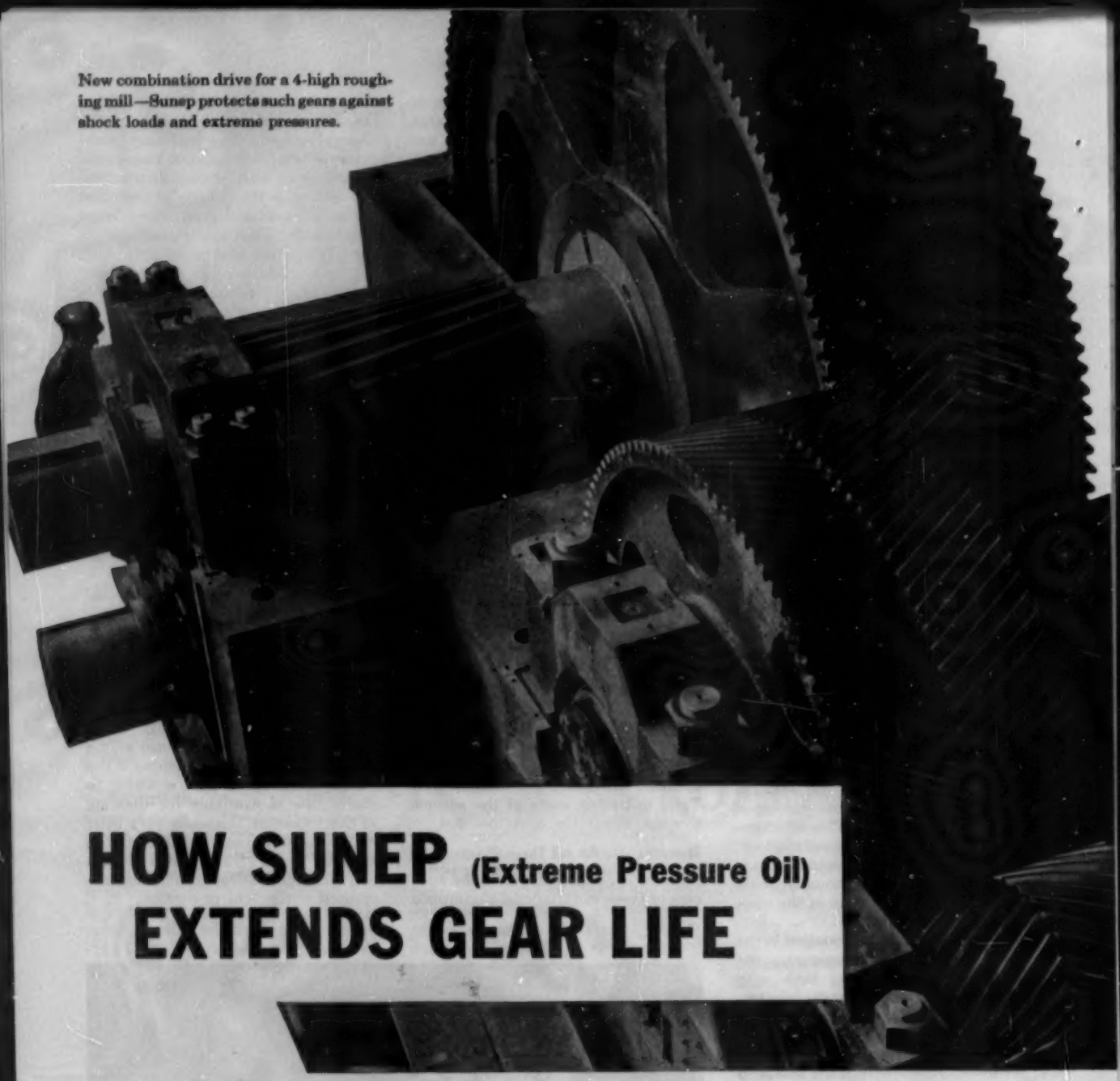
There is no question as to the success of these installations. Conditions at Du Pont are visibly better. Maintenance crews work freely in the conveyor areas. The bulldozer operator works without a respirator. There is no sign of coal dust in the air either on the outside of the plant or in the enclosed area. There is no dust on the electrical equipment. In fact, the power plant area is as clean as the rest of the plant, which means practically spotless. Housekeeping is a simple, routine procedure.

At Hiram Walker results have been equally good. With the coal dust controlled at its source, the plant now has a completely clean firing-handling system. Personnel are able to maintain the wetting facilities with a minimum of effort, the bulk of the work being periodic cleaning of the nozzles and water lines. Incidence of spontaneous combustion in the bunkers has been materially reduced, and the application of sprays to the underside of the main conveyor belt has eliminated the slippage problem.

Engineers at International Harvester are pleased with their system. The plant is near the Fort Wayne city limits and close to numerous other industrial plants. Effective dust control in a location of this type goes a long way toward improving community relations. Although small balls of ice occasionally form at the nozzles below the track hopper if the temperature falls below zero (a steam line is available for thawing at this location), normally very little maintenance is required. Benefits in addition to the cleaner surroundings include improved operation and increased equipment protection.



At Du Pont, the solution pump is installed beside the proportioning assembly. A ratio of 750 to 1 (water to wetting compound) provides effective results.



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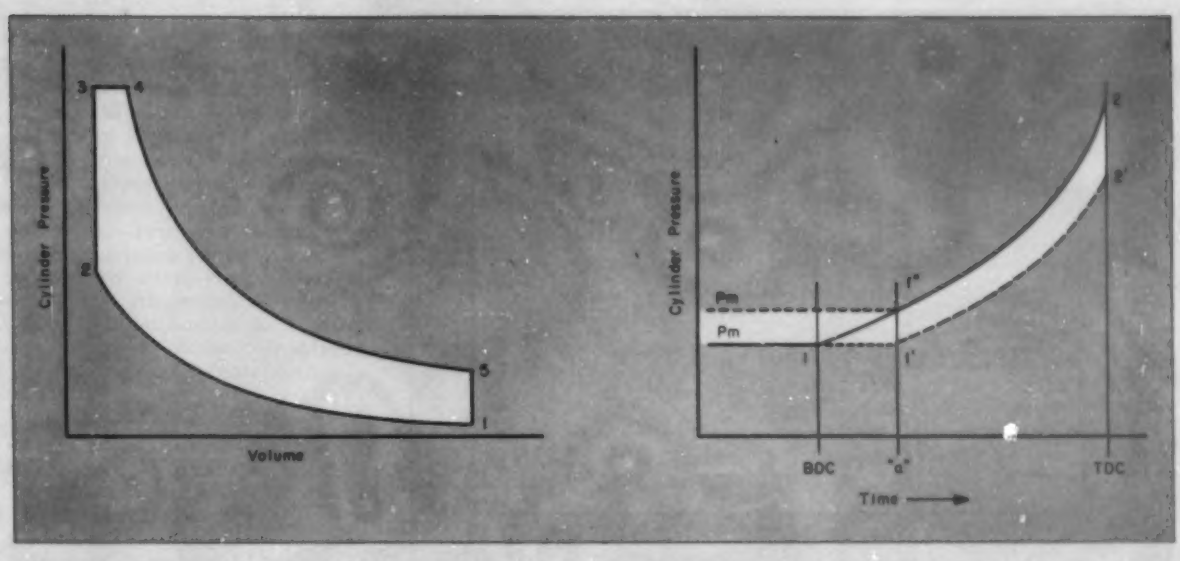

Figs. 1 and 2—It is possible to reduce the net compression ratio in both two and four cycle engines by beginning compression at 1' (Fig. 2 at right) and by supercharging at the manifold to maintain a constant compression pressure.

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Consulting Engineer

THE MILLER SUPERCHARGING system is a means of extracting high specific output from an internal combustion engine without exceeding its safe thermal load — heat flow through the piston crown, rings, liner. Since the thermal load is dependent on the mean cycle temperature and the mean cycle pressure, if either or both can be reduced, the thermal load can be reduced. One of the features of the Miller Supercharging System is that it substantially reduces the mean cycle temperature of the engine.

For any given engine there is a maximum safe thermal load depending on the expected engine life. Since this safe thermal load is determined by the mean cycle temperature and pressure, the problem, then, is to supply sufficient air for combustion and to burn the fuel in this air without exceeding the safe thermal load.

The temperature rise during combustion is a function of the amount of heat added (amount of fuel burned) and the amount of air receiving this heat. The amount of heat added at a given load is a function of the thermal efficiency and will be considered as constant. A compression ignition engine has the property of being able to operate on a wide range of air-fuel ratios. This is borne out by the fact that the most common method of governing the diesel engine is to meter the amount of fuel to be burned in a given quantity of air in the cylinder.

For a given indicated mean effective pressure (IMEP) at constant thermal efficiency, the temperature at the end of combustion can be reduced by increasing the amount of air supplied. (Air is supplied at a constant temperature.)

In the conventional engine in which the inlet valve is closed at, or slightly after, bottom dead center, the amount of air available for the cycle can only be increased by an increase in compression pressure. This, of course, calls for an increase in compression work. If the thermal efficiency of the cycle is to remain constant, much higher firing pressures must be used to offset this increased compression work. The high firing pressures are objectionable because of the additional structural strength that must be incorporated in the engine design. The net results of a cycle with high excess air is a very slight reduction in thermal load and the disadvantage of excessive firing pressures.

There is, fortunately, another approach to the thermal load problem.

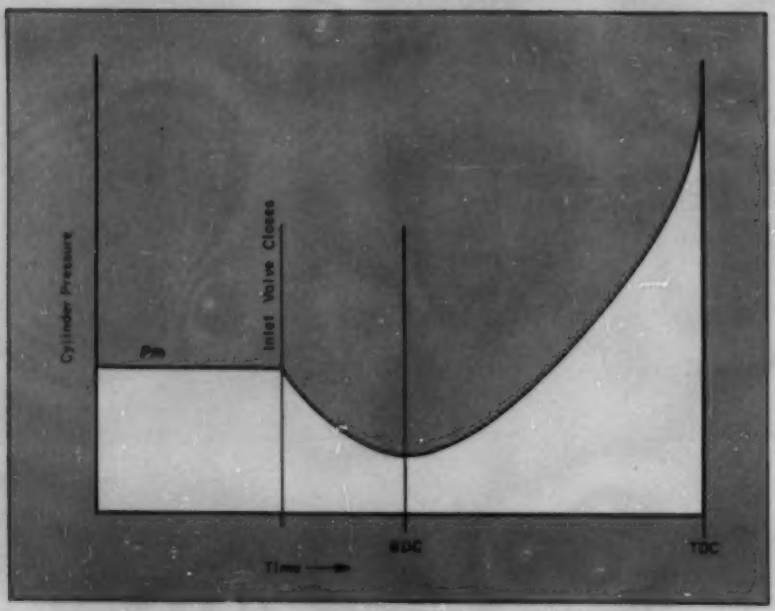


Fig. 3—The net compression ratio in a four-cycle engine can be reduced by allowing the inlet valve to close before completion of the suction stroke.

The compression temperature is the other variable in the determination of the maximum cycle temperature. If the compression temperature can be reduced, and the same temperature rise during combustion can be maintained, then the maximum temperature and the mean cycle temperature can be reduced. With the temperature of the air supplied to the inlet manifold from the intercooler constant, the equation for the compression temperature can be stated as follows:

$$T_2 = T_1 \left[\frac{V_1}{V_2}\right]^{K-1}$$

where the subscripts refer to the P-V diagram on Fig. 1.

In the conventionally timed engine, where the inlet valve is closed slightly after bottom dead center in the compression stroke, T_1 is the manifold temperature. Since the manifold temperature is constant, one way to decrease the compression temperature is to lower the compression ratio by increasing the clearance volume. However, reducing the expansion ratio also reduces the thermal efficiency of the cycle.

Compression Ratio

Another method of decreasing the compression ratio is to reduce the length of the compression stroke while maintaining the original expansion stroke. This gives the desired results of a lower compression temperature and the original thermal efficiency although actually building the linkages involved in obtaining strokes of different lengths would be expensive.

If the effective stroke, rather than the actual stroke, is changed, then the same results are possible. This can be done by changing the valve timing rather than changing the length of piston stroke. If the resulting compression ratio is called the net compression ratio (R_n), then the compression temperature is:

$$T_2 = T_m (R_n)^{K-1}$$

Fig. 2 shows the relationship between these factors on the pressure-time diagram. In the conventional engine, compression is carried out from point 1 to point 2. If the net compression ratio is changed by beginning compression at 1' with the same manifold pressure as before, the compression temperature and pressure will also be lower. In order to maintain a constant compression pressure, a higher manifold pressure (supercharging) must be supplied if the net compression ratio is reduced. The method outlined is applicable to both two and four cycle diesel operated engines.

Valve Settings

There are several means of setting the beginning of compression (point "a" in Fig. 2). In the case of uniflow, two cycle engines with exhaust valves in the head, the exhaust valves can be held open until point "a." In the loop scavenged engines, an auxiliary exhaust valve can be added, and the timing can be varied with it. In four cycle engines, the inlet valve can be held open considerably past bottom dead center (BDC) until the piston is in the position that is desired.

Another Method

Another means of accomplishing the same end is available in the four cycle engine and is shown on Fig. 3. Here, the inlet valve is closed before completion of the suction stroke. The cylinder charge is then expanded from manifold conditions to a lower pressure and temperature at bottom dead center. It is then compressed through the complete cylinder volume as in the conventional engine.

The amount of change required in

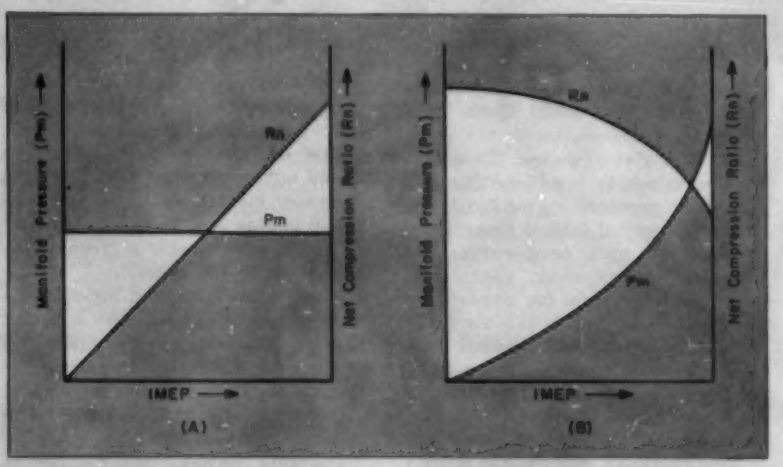


Fig. 4—Characteristic curves for constant speed engines supercharged by supplying air at constant pressure (4A) or by use of turbosupercharger (4B).

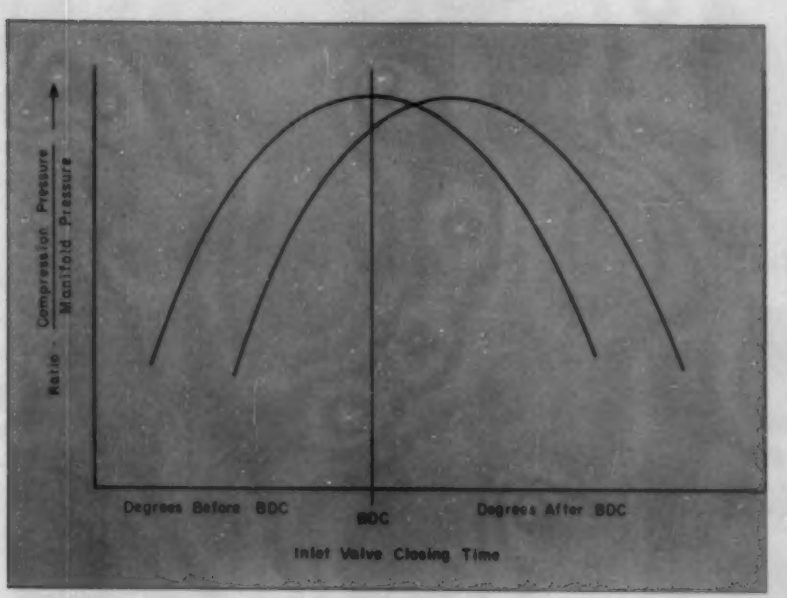


Fig. 5—The ratio of the compression pressure to the manifold pressure varies with the closing position of the inlet valve on the engine cylinder.

the net compression ratio of a given engine depends on the relationship between the pressure output of the supercharger and the engine load. Constant speed engines usually operate on one of the types of supercharging shown on Fig. 4. In Fig. 4A, the inlet manifold of the engine is supplied with air at constant pressure for all loads. The net compression ratio must increase with load in order to provide sufficient air for combustion.

The most common type of supercharging is by the use of a turbosupercharger driven by the exhaust gases from the engine. The turbosupercharger for a constant speed engine has a discharge pressure characteristic as shown in Fig. 4B. The pressure rises rapidly as full load operation is reached.

There are several methods of varying the valve timing and, of course, the method used on any given engine will depend on a number of individual variables. Fig. 5 shows how the P_s/P_m ratio varies with the inlet valve closing position. The difference between the "actual" curve and the "theoretical" curve is due to the throttling effect of the valves at their partially open positions. This difference increases as engine speed increases.

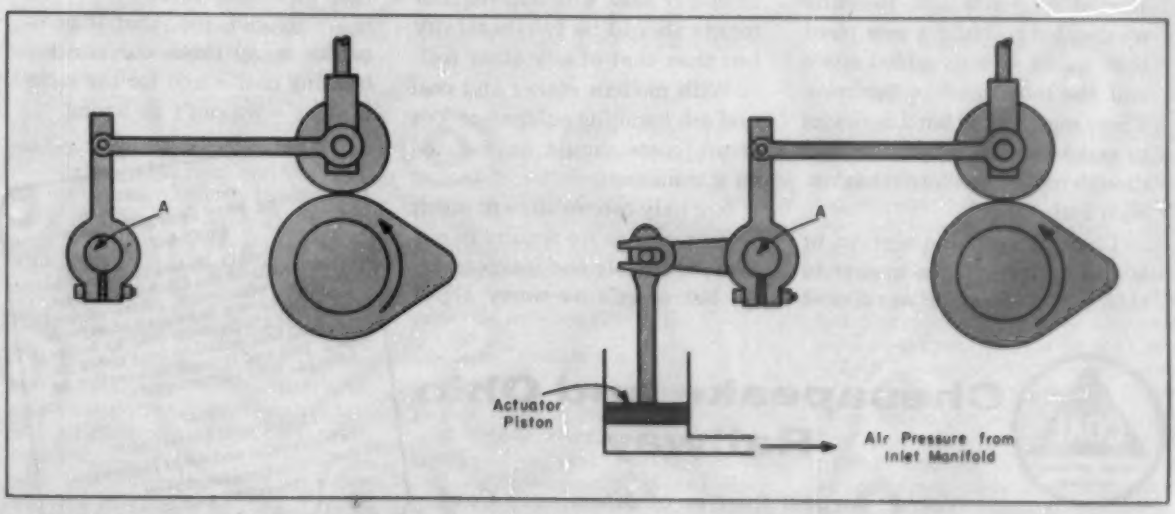
Valve Timing

One method of changing the valve timing is shown in Fig. 6. As shaft "A" is moved clockwise, the cam follower moves to the right on the base circle of the cam causing earlier contact with the cam lobe and thereby advancing the opening and closing of the valve. Some means must be used to change the position of shaft "A" as engine load is varied. This can be done by the engine governor; but another solution is to vary the inlet valve closing position (and, therefore, the net compression ratio) by means of the inlet manifold pressure to the cylinders.

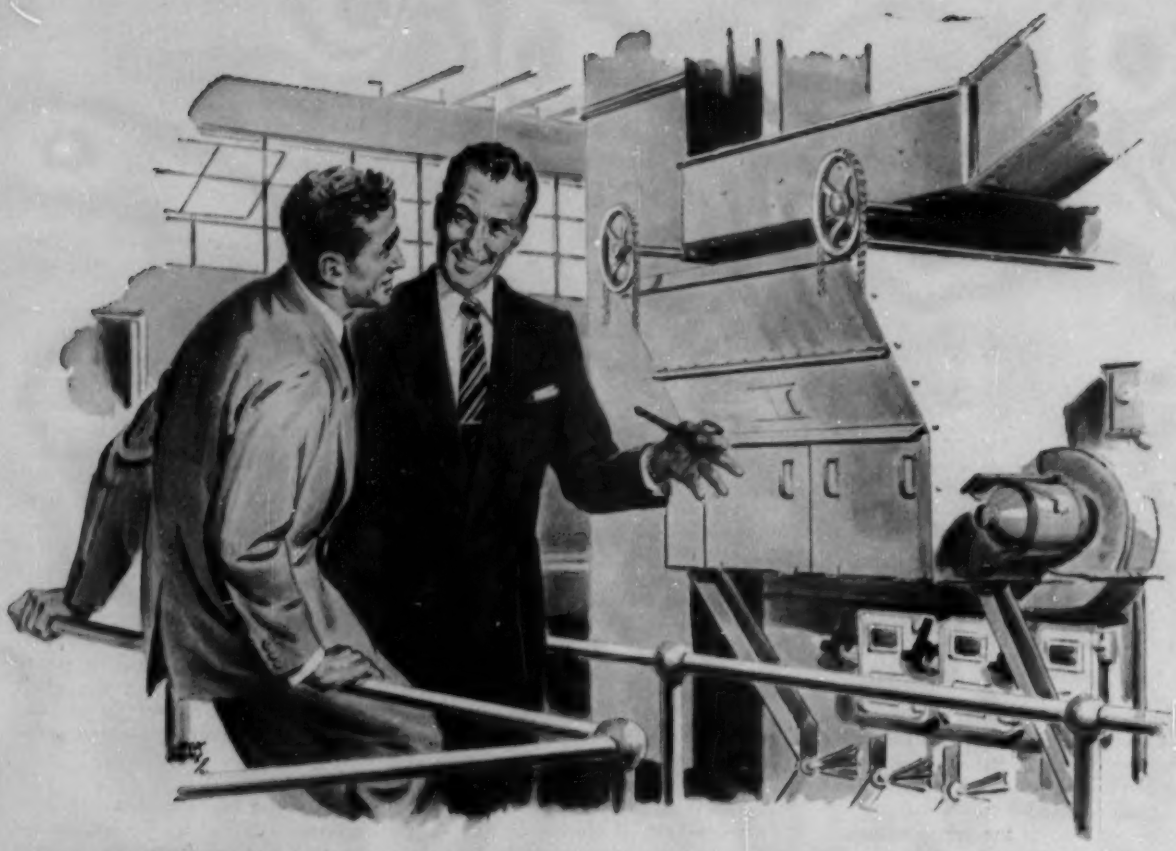
Fig. 7 shows the simplest means of varying the inlet valve closing position. As the air manifold pressure builds up, the actuator piston moves upward, rotating the shaft "A" in a clockwise direction and decreasing the net compression ratio.

New Applications

All of the engines operating and on order today on the Miller Supercharging System (totaling approximately 200,000 BHP) operate on the four stroke cycle. However, two cycle engines operating on the Miller Supercharging System show an even greater increase in rating than the four cycle engines. The two cycle applications are being developed.



Figs. 6 and 7—Two methods of changing valve timing. As shaft "A" moves clockwise, the cam follower advances the opening and closing of the valve. Shaft "A" can be operated from the engine governor or by the inlet manifold pressure.



"Here's where we can't go wrong," I told John

John is my partner in a small manufacturing enterprise we started six years ago. Recently we decided to build a new plant that would give us added space and the most modern facilities. There were a lot of hard decisions to make because we just haven't enough money to afford mistakes, even little ones.

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Left to right — Main can-bin building, can elevator from yard level hopper, enclosed dirt elevator, and glass elevator.

Bulk Handling as a Business

VARIOUS TYPES of rubbish and discards enter at one end, useful salvaged products go out at the other end. Briefly, that is the function of the Los Angeles By-Products Company plant in Los Angeles, California. More accurately, this plant processes bulk rubbish to salvage useful materials — metal used in the copper industry, cullet for glass plants, and other valuables.

This plant has two general points of entry: one for noncombustible wastes weighing approximately 450 pounds per cubic yard, and the other for a material comprised of practically 100 percent cans. These materials travel separate routes through the plant — routes in which conveyors play an important role.

I&P EXCLUSIVE

S. G. GILLETTE
Chief Engineer
Los Angeles By-Product Co.

C. A. HOYA
Engineer
Chain Belt Co.

Circuit for Noncombustibles

Noncombustible rubbish arrives at the plant in end-dump trucks, side-dump trucks, and semitrailers and is delivered to the main can-bin building. This building is equipped with two parallel rows of receiving hoppers at yard level. One row of hoppers is outdoors, along one face of the building, while the other row is inside. End-dump trucks use the outside hoppers, the trucks being parked in suitable stalls while discharging. Side-dump trucks enter through one end of the building and discharge their loads into the inside hoppers. Semitrailers also are unloaded indoors with the aid of a series of suitable cranes.

Tandem Conveyor Lines

Rubbish from the two rows of receiving hoppers flows onto two, parallel lines of 60-in., horizontal, leakproof pan conveyors located in the building basement. Both of these lines contain two units — each with deep, full-length, stationary skirt plates — arranged in tandem so that rubbish travels from the ends of the hopper rows toward a common midpoint. The two, parallel units serving one end of the building discharge onto a cross, 48-in., leakproof pan conveyor near the center of the building, while their tandem counterparts serving the other end of the building discharge onto a duplicate cross conveyor, parallel to the first.

Both tandem conveyor lines serve as preliminary picking tables. Operators, along one side of each of the four conveyors, control the flow of rubbish from the overhead hoppers by actuating individual, hydraulically-operated discharge gates under each hopper. These operators also remove large, unwieldy objects

Noncombustibles pass through hydraulically operated gates to two, parallel lines of tandem pan conveyors.

View looking down from main conveyor building shows the riffraff conveyor, flanked by the cross conveyors.

such as auto tires, hot water storage tanks, 5-gal cans, axles, bed springs, and other items of no value to the final product, when they arrive at the head ends of the conveyors.

Riffraff Conveyor

Bulky materials removed during the preliminary sorting are placed on chutes leading to a single riffraff conveyor. This unit, a 60-in., leakproof pan conveyor with 237-ft centers, is the longest conveyor in the plant. It is between and parallel to the twin, 48-in., cross conveyors, and includes three horizontal sections connected by two inclined sections—the inclined sections having a total rise of 40 feet. The horizontal sections are in the subbasement of the main can-bin building; at yard level where the conveyor passes through the main conveyor building; and at the elevated head end. This last section serves as a final sorting table where objects are removed and tossed into bins for disposal.

Rubbish discharged from the tandem conveyors in the basement of the main can-bin building is elevated 33 feet by the twin, 48-in., cross conveyors to the main conveyor building. Here the rubbish is chuted onto the foot ends of twin, horizontal, 48-in., picking-belt conveyors. These belt conveyors are located on both sides of the riffraff conveyor that passes through the building along its centerline.

Above and parallel to each picking-belt conveyor are two, short, inclined, overlapping, 48-in., belt conveyors, each with a magnetic foot pulley located only a short distance above the picking belt. Magnetic materials, such as cans, traveling on the picking belt are attracted to these foot pulleys and in turn carried up the short belt inclines. Since the units overlap, the second belt discharges onto the first belt, while the first belt discharges onto a cross, 36-in., belt conveyor feeding a rotary screen. This arrangement provides dual protection because any magnetic material that escapes the foot pulley of the first belt is caught by the foot pulley of the second belt.

Materials on the section of each picking belt beyond the second magnetic pulley are sorted by operators who remove bottles and broken glass suitable for cullet. Such material is tossed into chutes along one side of each conveyor. Each set of chutes passes through the floor to a short, 18-in., horizontal, belt conveyor, parallel to the picking belts and suspended from the ceiling of the basement. These conveyors feed the horizontal leg of a hinged-bucket elevator with 12-in. long buckets mounted between 12-in. pitch chain, located at right angles to the picking belts. This unit elevates the material 36 feet to an outside, overhead bin.

Wastes passing over the head ends of the two picking belts — dirt and other material unfit for further use — is chuted onto the horizontal leg of another hinged-bucket elevator. This elevator, also located at right angles to the picking belts, has 36-in. long buckets mounted between 18-in. pitch chain. It is enclosed in a shaft, and discharges into another outside, overhead bin.

Circuit for Cans

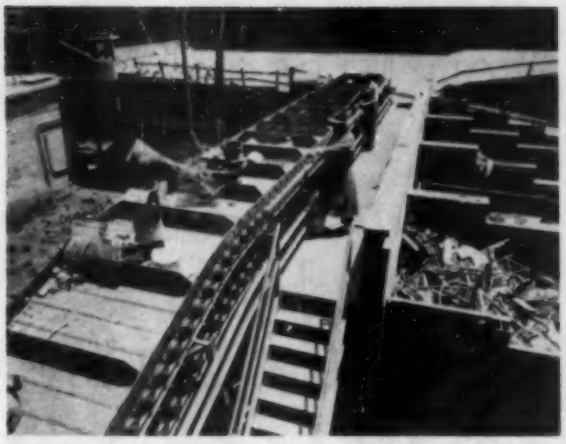
The other point of entry at the plant is for the material comprised of cans. This material is obtained from outside sources, such as can dumps, and from collecting stations of the company, where cans have been sorted to some degree. Semitrailers haul these cans to the processing plant where they are discharged into a large, yard-level hopper near the main conveyor building.

An inclined, hinged-bucket elevator, with 36-in. long buckets between 18-in. pitch chain, removes the cans from this hopper and delivers them into the main conveyor building. Here the cans are chuted onto either of the 48-in. picking belts at receiving points just ahead of the first magnetic pulleys. Suitable cans are removed by the magnetic pulleys and delivered to the rotary screens, while unfit materials join the noncombustible rubbish passing to the outside, overhead bin.

Can Salvaging Operation

Processing of the can material is done on a separate circuit parallel to that of the noncombustible rubbish. The rotary screens free the cans from some of the dirt, which is returned to the nearest 48-in., picking belt by means of a small, cross belt conveyor. Then each screen feeds its cans onto an inclined, hinged-bucket elevator, of the same type and size as the unit serving the yard-level, can receiving hopper. These elevators discharge into opposite ends of a long, clean-can bin.

A series of rack-and-pinion slide gates beneath the clean-can bin control the flow of cans onto a 36-in., leakproof pan conveyor of 81-ft horizontal centers. This unit has a right-angle discharge onto another inclined, hinged-bucket elevator, which in turn has a right-angle discharge onto a 48-in., horizontal, belt conveyor leading to the incinerator. Operators at this point give the ma-



Elevated head end section of riffraff conveyor serves as a final sorting table for removing bulky materials.

Two, overlapping, picking belt conveyors with magnetic foot pulleys transfer cans to a separate circuit.

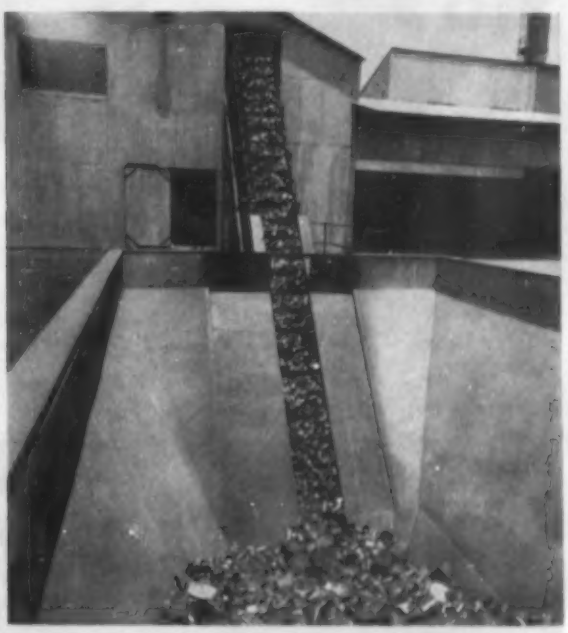
terial a final inspection and remove tramp iron or other objects that would prove injurious to the balance of the process.

During the incinerating process a 60-in., perforated apron conveyor carries the cans over a series of burners and then dumps them onto a 30-in., leakproof pan conveyor that passes through a water spray for quenching. The quenched cans are carried by a hinged-bucket elevator to a 30-ft long rotary screen, tumbled to loosen dirt and ashes, and discharged to a shredder. The final shredded material, used in a leaching process in copper mills, goes either directly to railroad cars for shipment or to storage bins.

All of the leakproof pan conveyors in the plant are of the same construction — ¼ in. steel overlapping pans, 9-in. pitch, and 6-in. high ends — and differ only in pan length (conveyor width). The pans have equalizing-saddle mountings on double-strand steel roller chain. A square rod or axle passes through the center of each pair of opposite links to large-diameter, outboard traction rollers on each side. Conveyors operating on inclines have occasional pans with pusher angles.

Hinged-bucket elevators also are all of the same construction. The buckets are made of 3/16-in. steel plate and have piano-hinge junctions. Size differences are in the pitch and bucket length. Buckets are mounted between two strands of steel roller chain having a through rod at every link. The Los Angeles By-Products Company fabricated and erected all of the conveying equipment, using Rex leakproof pan conveyor and hinged-bucket elevator elements furnished by the Chain Belt Company.

Bucket elevator carries broken glass to a storage bin. Shaft at left is part of the dirt elevator enclosure.



Elevator from a yard level receiving hopper delivers cans to the system just ahead of the magnetic pulleys.

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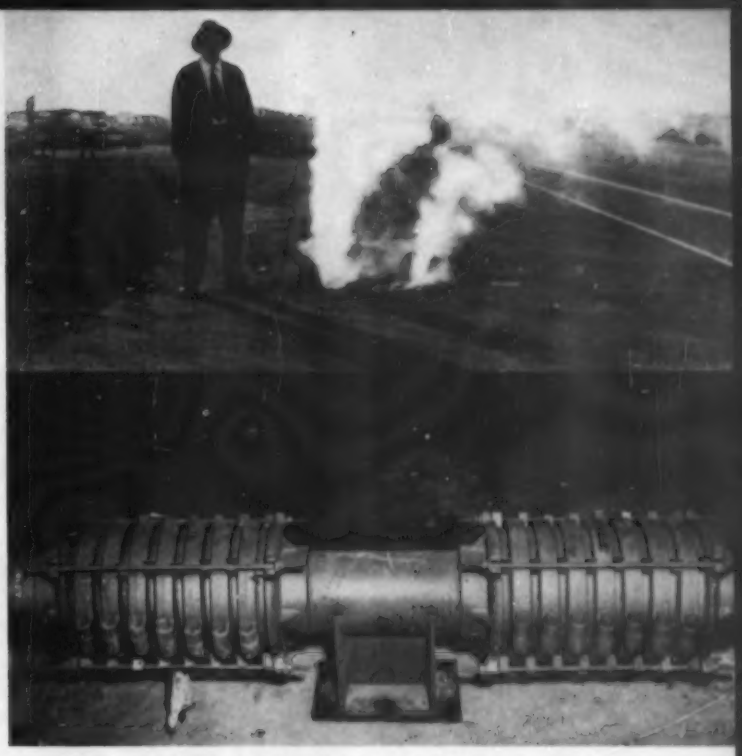
The Trend is Towards

Eliminating Maintenance on Expansion Joints



An annual steam loss of over $17,500 through antiquated expansion joints was eliminated by installing a modern unit.

I&P EXCLUSIVE

The plant engineer can look forward to the day, in the not too distant future, when he can install an expansion joint in a line and forget about it. For the present, however, expansion joints still require inspection and maintenance.

A. C. STIMES, Project Engineer
Flexonics Corp.
Maywood, Illinois

THE SEARCH for a trouble-free expansion joint is by no means over, but many important developments have been made in recent years. Originally, pipe bends and loops were the only means available for the solution of difficult thermal pipeline expansion problems. Then, slip-type joints were developed and gradually came into common usage. Recent improvements have led to the development of the rubber, the plate-type, and the bellows-type expansion joints — each designed with an eye to trouble-free operation and minimum maintenance.

In most plants where they are used, pipe loops require only painting and insulation maintenance work. While it is a relatively small expenditure, the several feet of pipe in each loop, multiplied by the number of loops, does amount to a measurable maintenance cost when the labor and materials used for painting and insulation are considered.

Slip-type expansion joints require a packing to insure a seal. Maintenance personnel must periodically lubricate these units with an insoluble graphite grease packing. As the slip-type expansion joint becomes older and worn, it must be repacked more frequently. A badly worn slip joint leaking steam, water, or other fluid, will add a safety hazard to a maintenance problem.

Plate-type expansion joints require little maintenance when properly installed. Providing the lines are properly anchored and guided, there is rare occasion for failure. Although the "V" shaped corrugations in a plate-type joint without an inner liner may permit the accumulation of scale, there is little that plant maintenance personnel can do about this problem. For all practical purposes, plate-type expansion joints require no special maintenance. The heat loss is minute when compared with an uninsulated pipe loop.

Rubber expansion joints, although limited in their pressure and temperature capabilities, require little or no maintenance. It is necessary to retighten the bolts some time after installation to compensate for the slight set the rubber takes.

Bellows-Type

Among the latest developments in expansion joints is the bellows-type, which, when properly selected and installed in an anchored and guided line, requires virtually no maintenance. The bellows-type is furnished with and without control rings and is welded or bolted into the plant piping system. These units are gaining wide acceptance in central steam heating lines.

In older installations, the expansion joints are generally installed in manholes for access by maintenance personnel. There is a growing tendency to entirely eliminate the man-

Dual controlled-flexing expansion joint handles steam at 175 psi and 400 F.

Expansion unit in heating trench under streets eliminates need for manholes.

holes in newer installations. This practice can be recommended for central heating plants where there is limited cycling required of the expansion joints — turning on the system in the fall and shutting it down for the summer. Most plant engineers are still reluctant to bury their expansion joints where the cycling is more frequent, even though manufacturers design the units for a life of many thousands of cycles.

Inspection

An annual inspection is common in most plants, particularly in the continuous process industries. These plants repair their pipelines with the annual shutdown, usually scheduled in the summer to coincide with the vacation season. The heating system is generally shut off at this time. Prior to the plant closing, plant engineering personnel inspect the piping and piping components while in operation and note any apparent defects. These defects, along with any other defects discovered during the overhaul, are then corrected.

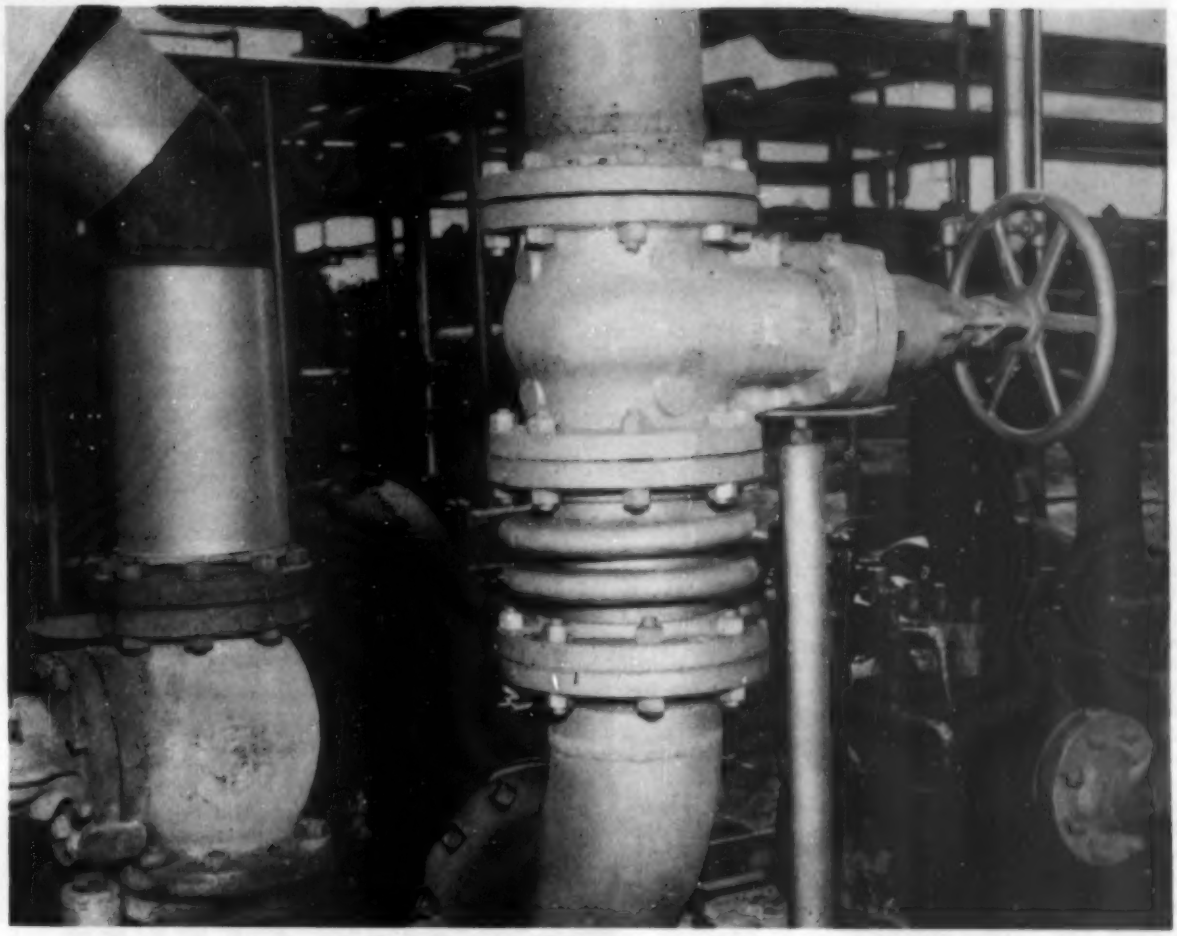
Interim Check-ups

Interim inspections (and complaints from operating personnel) may reveal faulty valves, leaky gaskets, loosened guides and anchors, worn insulation, and defective expansion joints. Expansion joints are like valves in that they permit only an inspection of their exterior in these check-ups. The repair and replacement of insulation, painting of the lines, tightening guides and anchors, and servicing some types of expansion joints may be done without shutting off the line.

Slip-type expansion joints are serviced on a scheduled basis in some plants. The new slip-type joints permit repacking under pressure with no shutdown required. Frequently they are not repacked until operating personnel complain.

Bellows-Type

There is generally no planned program of maintenance or inspection for the bellows-type expansion joints. Rarely are lines cut in order to conduct a routine inspection of expansion joint interiors. This is particularly true for units welded into the lines. The replacement of worn gaskets on flange faces may prompt the opening of flanged piping. Few commercial gaskets will match the service life of an expansion joint. Occasionally, foreign materials fall into the external control rings and apparatus of high pressure expansion joints and interfere with their proper functioning. Be-



An oil refinery application uses the free-flexing bellows-type expansion joint on a line handling steam at 200 F.

fore the control apparatus can be completely removed, however, the pressure must be taken off the line.

Of concern to plant engineers is the replacement of defective expansion joints. Improper selection of expansion joints for the piping requirements, incorrect installation, and inadequate anchoring and guiding, cause the large majority of failures. Expansion joint failure or potential failure can be detected by excessive leakage of fluid and packing from slip joints; deformation of expansion units by improper installation; deterioration of rubber in rubber joints; corrosion of metal expansion elements.

The metal walls in the plate-type and bellows-type expansion joints are necessarily thin so as to assure flexibility. They are more susceptible to corrosive attack and fatigue failure than the schedule 30 to 80 pipe in which they are mounted. Corrosion resistant stainless steel units should be specified when the conditions seem to dictate their use.

The evidence is dramatic when anchors fail and piping and expansion joints are destroyed. Heavy walls can be pushed away and piping torn out. The most careful maintenance and inspection procedures may not prevent these failures which are usually due to improper installation. The danger to personnel, the interruption of production and services, and the cost of repairs point out the need for correct piping design. It cannot be emphasized too strongly that the basic purpose of an expansion joint is to handle thermal expansion, not to absorb the pipe thrust resulting from poor anchoring of the pipelines.

Underground

For underground installations in pits and tunnels, many companies prefer the bellows-type and the plate-type expansion joints because of the difficulty of access and the disagreeable working conditions for maintenance men attempting to service slip-joints in these locations. The practice of sealing expansion joints in underground trenches has been mentioned earlier.

Other Considerations

In addition to maintenance costs, plant engineering personnel must also consider original costs and design factors such as traverse, lateral deflection, angular motions, pressures, and fatigue life, in selecting the most suitable expansion joint. In comparing expansion joints and pipe loops, space requirements and heat loss must be considered. It is recommended that maintenance departments keep a small stock of expansion joints of the same nominal pipe size as the plant piping on hand. As the older type expansion joints begin to require excessive attention and become too costly to operate, they can be replaced with one of the newer types, thereby reducing future maintenance costs.

ideas in action

. . . in U. S. industrial plants

NFPA Releases Additional Electrical Code Interpretations

Four official interpretations of the 1953 National Electrical Code have been released by the National Fire Protection Association. These are in addition to the official interpretations of the '53 Code previously released and published by NFPA in the '54 edition of the National Fire Codes, Vol. V, Electrical.

Sections 4402 and 4328: Protective Devices for Motors

Statement:—A hermetically sealed condensing unit, utilizing a two hp motor is protected by a single pole inherent overheating protective device. The motor and protective device have been tested as a unit and found acceptable. The unit is controlled by a double pole pressure switch suitable for the application. The supply is 230 v, single phase through a double pole, double fused, 60 amp, 230 v enclosed switch. The switch is within sight of the unit and not more then ten feet away.

Q.—May this switch be used as a disconnecting means as required by Section 4402?

A.—Yes.

Q. — Does Section 4328 prohibit use of a single pole inherent overheating protective device as the motor running protection?

A.—No.

Interpretation No. 405

Section 3464; Conduit Installation

Q.—Does Section 3464 require treatment of conduit threads with paint or other material in order to assure water tightness?

A.—No.

Interpretation No. 406

Section 4409 and 4402; Disconnecting Means for Motors

Statement:—A motor exceeding 50 hp, supplied by an individual branch circuit is fed through a circuit breaker installed in a panelboard capable of being locked. The motor controller is located within sight of the motor. Control circuit of controller is connected in series with a push button switch located adjacent to the motor. When the stop button of this push button switch is operated, it opens the circuit to the motor controller.

Q.—May the circuit breaker in the lock-type cabinet be accepted as the disconnecting means and satisfy the provisions of Section 4409?

A.—No.

Q.—May the push button control switch, which can place the controller in an open position, be considered as the disconnecting means required by Section 4402?

A.—No.

Interpretation No. 407

Section 4124; Combustibility of Wall and Ceiling Finish

Statement:—Section 4124 requires that any combustible wall or ceiling finish exposed between the edge of a ceiling fixture or pan and an outlet box be covered with noncombustible material.

Q.—To what extent must the material be combustible to fall within the intent of this section?

A.—Combustible in the sense used in this section was intended to apply to materials such as wood, wall paper, burlap, and other combustible cloths and plastic fabrics, combustible wall board, and the like to the extent that ignition could be started by an arc or the high temperature of a defective connection. Inspection authority would be expected to make the final determination.

Q.—To what extent would a material have to be noncombustible to fall within the intent of non-combustible as used within this section?

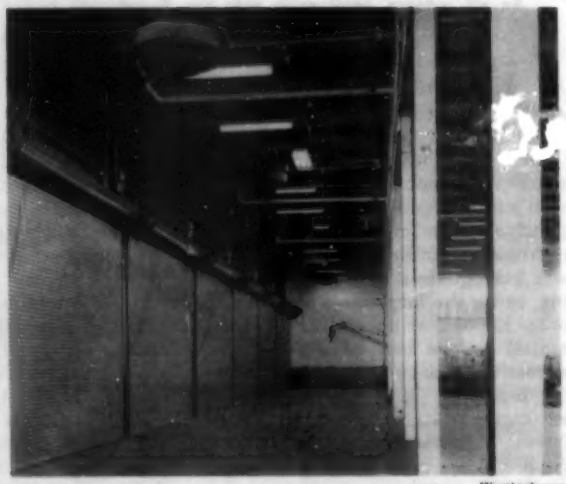
A.—Non-combustible was intended to apply to materials that would not normally support combustion nor convey flame, such as asbestos, plaster, and most metals.

Unit Heaters Provide Versatile, Trouble-Free Service

One of the important services necessary in manufacturing and other industrial plants is an efficient, trouble-free, plant-wide heating system.

One of the better methods of providing quick, dependable, and efficient heating in the plant is with unit heaters. An example of successful use of unit heater installations is at the $45 million Westinghouse plant in Columbus, Ohio covering 45 acres of plant area.

The plant contains four manufacturing aisles, each 200 ft wide and extending approximately 1500 ft. These



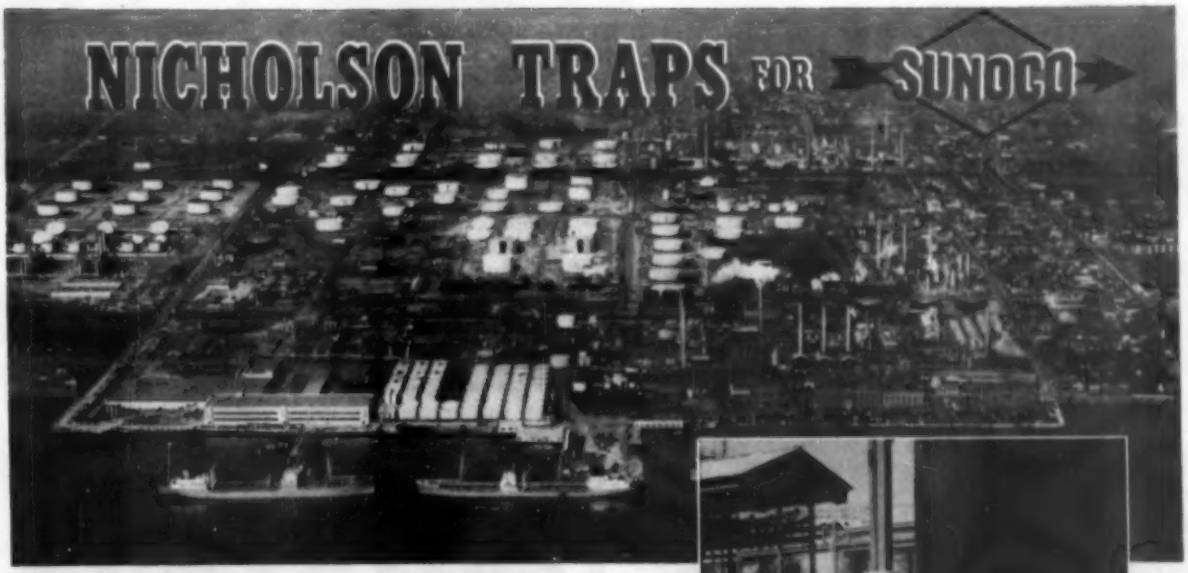
Westinghouse

Ceiling mounted units provide heat above truck doors.

aisles lead in a straight-line production pattern to the warehouse area which has a storage capacity of 100,000 major household appliances.

The entire working area is well provided with warmth from the company's own unit heaters. The wide truck entrances are blanketed with heat from units mounted on the ceiling. In plants where these areas are not

NICHOLSON TRAPS FOR SUNOCO



Air view of Sun Oil Company's refinery at Marcus Hook, Penna.

Standard for

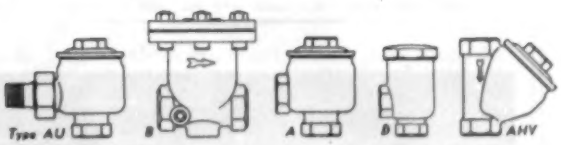
OUTDOOR USE

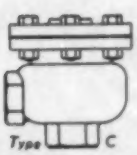
Due to

FREEZE-PROOF

Feature

Nicholson steam traps are shown above installed on storage tanks requiring heating at Sun Oil Company's Marcus Hook, Pa., refinery. Sun has standardized on this type of installation.





SIX TYPES FOR PROCESS, HEAT AND POWER -- Construction of bronze, semisteel or cast steel. In sizes of ¼" to 2" for pressures to 300 lbs. All six types of traps have stainless steel valves and seats. Bellows are furnished in bronze, monel or stainless steel.

Send for TRAP CATALOG

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

135 Oregon Street, Wilkes-Barre, Pa.
Sales & Engineering Offices in 58 Key Cities

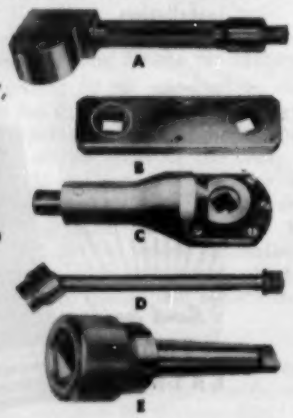
Circle 541 on Reply Card for more data

"We repair boiler tubes a lot faster now . . . with this

NEW WILSON CHAMFERING TOOL"

There's no longer any need to waste time with hand grinders or files to chamfer the ends of tubes before welding. This handy new Wilson tool (1) pilots the cutter to the tube; (2) has a taper shank which fits a standard air drill; (3) chamfers the tube edge to a 45° surface at high speed. It gives you a cleaner, stronger joint than outdated hand methods. It can also be used in boiler erection wherever several short lengths of tubing are welded together to form one long tube. Wilson also makes an inside chamfering tool for the placement of chill rings.

OTHER WILSON TIME-SAVERS for Boiler Erection and Maintenance



A Right Angle Worm Drive, used to drive expanders through handholes or from ends of headers. Made in ½", ¾" and 1" square sizes.

B Gear Train Drive available in ⅜", ½", ⅝", ¾", ⅞" and 1" square sizes.

C Extra Heavy Duty Right Angle Gear Drive, made in ¾" and 1" square sizes.

D Universal Drive Extension

E Mandrel Drive with Morse taper shank and changeabl square sockets. Available with ⅜", ½", ¾" or 1" square sockets.

Representatives in all principal cities

Thomas C. Wilson, Inc., 21-11 44th Ave., Long Island City 1, N. Y.

Cable address: "Tubeclean" New York

WILSON TW 637

TUBE CLEANERS • TUBE EXPANDERS

Circle 542 on Reply Card for more data

ideas in action

—Starts on page 86

protected, cold air spreads into the plant, causing discomfort and inconvenience to the employee.

Approximately six miles of railroad siding leads into the plant, and over these rails each day, when the plant is operating at maximum production, approximately 50 carloads of supplies are brought into the plant. Unit heaters also cover these freight car entrances keeping machinery and personnel protected from the cold air.

Since most of the units were installed near the ceiling or high on the walls, they did not interfere with work operations on the floor below and additional space was gained along walls by elimination of standing radiation and wall mounted pipe coils.

Because the heaters could be installed in cramped locations, Westinghouse plant engineers located them nearer to the space to be heated and then adjusted each heater to obtain desired hot air distribution pattern.

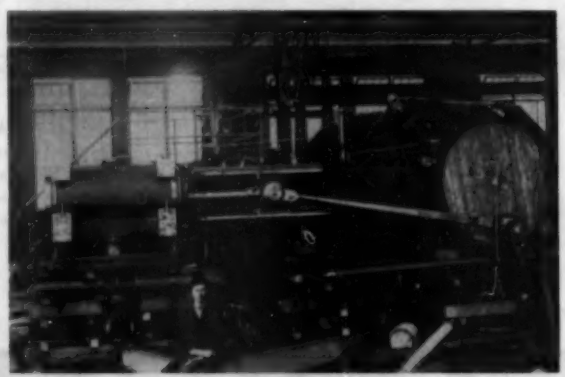
The heaters used can be controlled with a simple thermostat and a manual-automatic switch, or by a manual switch, or thermostat alone.

Radioactive Bromine "Sniffs Out" Leaks Under Concrete Floor

Plant engineers at a Toronto, Canada plant found that insufficient water from the steam traps of their radiators was being returned to the boiler. The suspected leaks could be anywhere along the 300 ft condensate return line which is buried under a six inch concrete floor and in some places under an additional 18 in. of soil.

For this leak-tracing job Isotope Products Ltd. selected bromine 82, a radioactive isotope with gamma rays capable of penetrating the concrete and soil, and with a 36 hr half-life. The isotope was used in the form of potassium bromide, a salt readily soluble in water.

The salt was dissolved in water and run through the condensate return line. As the line's course was fol-



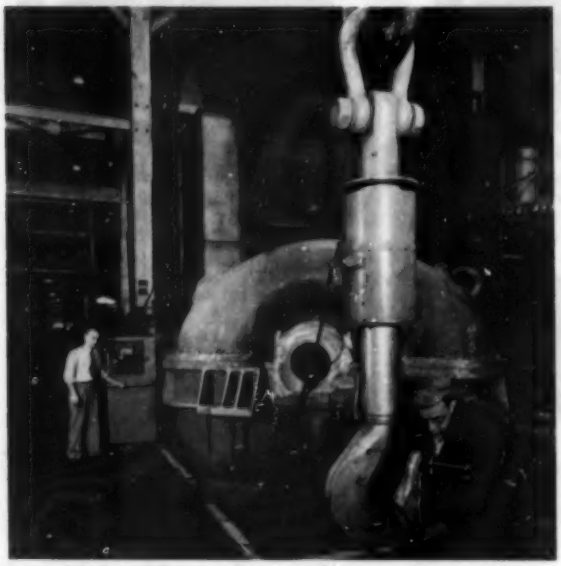
STEAM ENGINE, 1900 MODEL

Corliss steam engine at the Cooper-Bessemer plant in Mt. Vernon, Ohio awaits riggers for shipment. Year is 1900 when plant was known as C. & G. Cooper Co. Note wooden flywheel for erection and test purposes. Modern C-B engine of same hp takes 1/5 the space.

lowed with a Scintillometer, the instrument gave unusually high counts at five points. The solution was then pumped out and the line flushed with water. High readings were again noted at the same five points which indicated that the radioactive solution had leaked through the pipes at these locations. In about two weeks, when radioactivity had ceased, workmen were able to break through the concrete floor at the exact spots where the pipe was leaking.

Costs and Time Saved By Using Electric Crane Scale

Weighing of large parts (over 15 tons), assemblies, and housing of turbines, generators, and propulsion gears for shipment from General Electric's West Lynn, Mass. plant was complicated by the fact that the only



Before lifting the turbine assembly, weight of the chain is zeroed out on the Baldwin load indicator.

available large scale was almost a half mile from the plant. The parts were hoisted on a flat car or trailer, hauled to the scale, and then hauled back to the plant for shipment.

Installation of an electric crane scale of 50 tons capacity has reduced weighing costs 10 to 12 percent and is saving about 20 percent in time.

When not in use the scale rests on a cradle specially designed by G-E engineers. The cradle is supported on a dolly which can be pushed to the point of use.

The pick-up unit, a tension type load cell, is connected by cable to a Baldwin-Lima-Hamilton Corp. weight indicator also mounted on a dolly for transport.

In operation, tare weight can be zeroed out on the load indicator scale before picking up the load. Graduated in 200-lb divisions, the scale can be read to 50 lb. Weighing accuracy is 0.2 percent for loads above 15 tons.

Adoption of this type of crane scale was the direct result of experience with electrical weighing at the Pittsfield plant of G. E. where a Baldwin SR-4 load cell of 300,000 lb capacity is built into a hook block of one of the cranes used for handling transformers.

(Continued on page 102)

Westmoreland Coal Company

CRITERION COAL · HAMPTON COAL

We are proud to be affiliated with the Westmoreland Coal Company, which is celebrating its 100th Anniversary in 1954.

Stonega Coke and Coal Company

GLENBROOK · RODA · CROSSBROOK · STONEGA · DENDRON

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Crozer Coal and Land Company

LYNCO · CROZER

ANTHRACITE
Hazle Brook Raven Run Cross Creek
Hazle Brook Coal Company
Jeddo-Highland Coal Company

COAL HEATING SERVICE

General Coal Company

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Cable Address: GENCO

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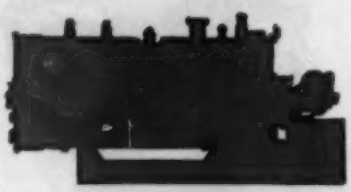
CINCINNATI · CLEVELAND · IRWIN, PA.
NEW YORK · NORFOLK

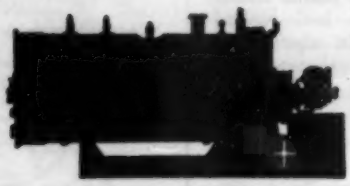
Circle 543 on Reply Card for more data

HOW SUPERIOR SOLVES YOUR STEAM PROBLEMS



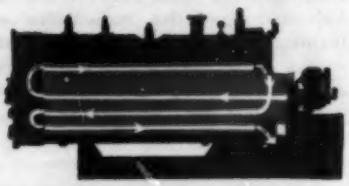
A COMPLETE PACKAGE

Completely factory-assembled and tested, a Superior Steam Generator is backed by undivided responsibility.



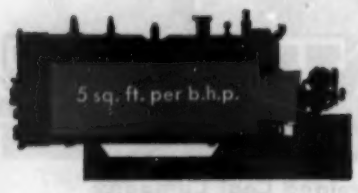
INDUCED DRAFT THAT'S BUILT-IN

... eliminates need of an expensive chimney ... Multiple fans draw evenly on all tubes, reducing maintenance.



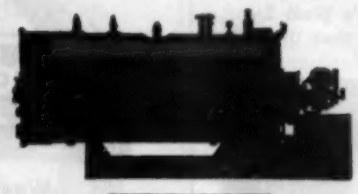
4-PASS, DOWN-DRAFT DESIGN

High gas velocities produce high efficiency. Down-draft design promotes rapid evaporation, quicker steaming.



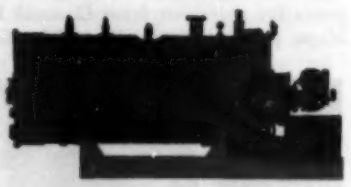
AMPLE HEATING SURFACE

A minimum of 5 sq. ft. of heating surface per boiler horsepower assures maximum efficiency at full rated capacity.



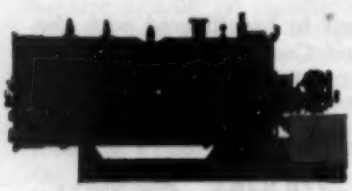
RESERVE CAPACITY

Greater steam space and large evaporating surface provide ample reserve capacity & better than 99% dry steam.



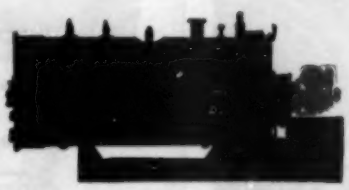
NO EXPENSIVE FOUNDATION

Built on a rigid channel iron base, a Superior Steam Generator needs only a floor capable of supporting its weight.



BUILT-IN CONTROLS

All controls essential to completely automatic operation are factory-wired into an easily accessible control panel.



BURN OIL, GAS, OR BOTH

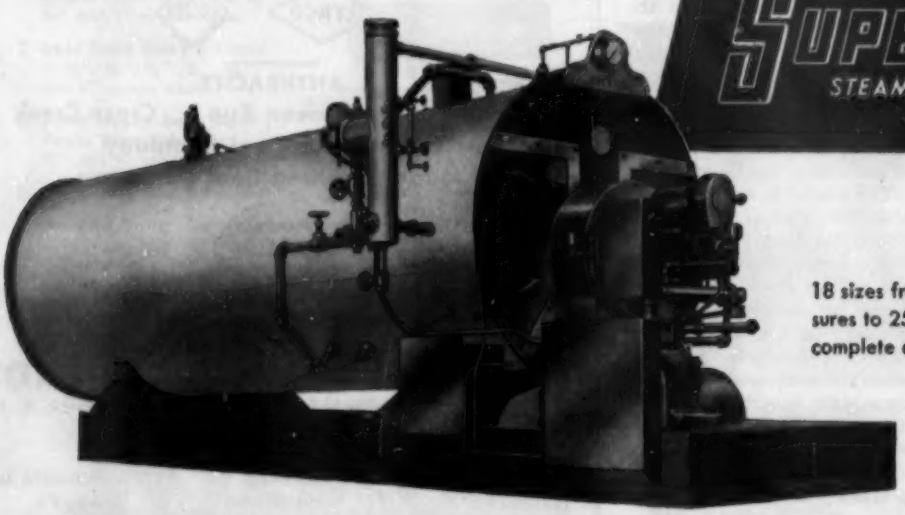
Superior Burners burn oil or gas or a combination of both ... changing from one fuel to the other in seconds.

Superior Steam Generators are the ideal choice for a new steam plant ... the simplest answer to expanding your present plant ... the easiest solution to replacing obsolete boilers.

Guaranteed to develop maximum rated capacities at thermal efficiencies in excess of 80%, their design embodies features which insure long-lived dependability and maximum fuel economy.

for performance you can **BANK** *on*

SUPERIOR
STEAM GENERATORS



18 sizes from 20 to 600 b.h.p. for pressures to 250 p.s.i. or for hot water. For complete details write for Catalog 502.

SUPERIOR COMBUSTION INDUSTRIES INC. TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

Circle 544 on Reply Card for more data

readers' guide

. . . an index to advertised products

The table below lists, according to product groupings, all equipment advertised in this issue. To request more data, circle key numbers on Reply Cards, pages 34/35 & 90/91

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	AIR FILTERS & DUST COLLECTORS		
548	Buell Engineering Co.	Dust collectors	97
545	Northern Blower Co., The	Dust Collectors	93
536	Schneible Co., Claude B.	Multi-wash dust collectors	49
	BOILERS & BOILER ACCESSORIES		
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539	Chesapeake and Ohio Railway	Coals	78
560	Combustion Engineering, Inc.	Boilers	107
543	General Coal Co.	Coals	89
503	Jerguson Gage & Valve Co.	Liquid level gage	6
554	Liquidometer Corp., The	Tank gage	102
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502	U. S. Electrical Motors, Inc.	Syncrogear motor	4
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507	Worthington Corp., Steam Turbine Div.	Steam turbines	11
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553	Standard Pressed Steel Co.	Solid steel collars	102
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506	Worthington Corp., Vertical Turbine Pump Div.	Vertical turbine pumps	10
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bulletins

. . . for listing of the bulletins just received see page 36

AIR CLEANING & DUST COLLECTION

250—Small Scale Dehydration

To meet the increased demand in engineering operations for small volumes of dry gases not warranting plant size installation, this company has developed the Hydryer, described in seven-page booklet. J. F. Pritchard & Co., Equipment Div.

252—Industrial Dusts

"The Collection and Recovery of Industrial Dusts," 32-page manual 101, discusses various types of dust and techniques used in analysis, lists the factors which influence choice of equipment, and explains the operation of each type of collector. Buell Engineering Co., Inc.

253—Precipitation Equipment

Engineers contemplating the installation of equipment for recovering dusts, fly ash, fumes, mists, fogs, or other similar suspensions in stack or process gases will find much valuable data in this 40-page booklet. Western Precipitation Corp.

254—Electrical Precipitators

Booklet 3-ATC covers the history and fundamentals of electrical precipitators, design and construction, dimensions and capacities, electronic power supply, selenium power supply, and installation stories. The Aerotec Corp.

255—Tubular Dust Collectors

Booklets 2-PDC and 3-PDC on mechanical dust collectors cover capacities and efficiencies, dimensions, construction and the decantation method used on installations where re-injection of large, unburned high carbon particles is required for economy. Prat-Daniel Corp.

256—Industrial Dusts

Booklet 3-TTC gives a brief background of modern dust problems and an approach to their solution. Discussed are sources of dust, determining dust size, prediction, fly-ash emission codes, types of dust and methods of control. The Thermix Corp.

257—Dust and Fume Removal

This 19-page bulletin, 610, pictures and describes the standard units that go to make up the Multi-Wash System for the removal of air-borne dust, fumes, vapors, and odors. Claude B. Schneible Co.

AIR CONDITIONING — HEATING & REFRIGERATION

259—Temperature, Moisture Control

Precision control of air temperature and moisture enable you to produce your product in any climate, at any season, according to six-page bulletin 122. The Type "A" air conditioner described, for drying or moistening of air, is shown in typical installations. Niagara Blower Co.

260—Savings With Cooling Towers

The question of how cooling towers save you money is answered fully in four-page booklet 402-A on Flow-Cold Cooling Towers. The five models illustrated and described have capacities ranging from 3 through 15 tons. Acme Industries, Inc.

261—Unit Heaters

Catalog CUH 846-A gives the complete story on Grid unit heaters. Catalog BC-1040 describes Grid blast coils for process drying. How the construction of the unit heaters prevents electrolytic corrosion is explained in booklet "Corrosion in Unit Heaters." D. J. Murray Manufacturing Co.

262—Steam Heating Systems

Five major types of steam heating systems, with and without control, and a full line of valves, traps, and steam power specialties are described in 19-page bulletin 110. It features the Selectotherm System which is an automatically controlled high vacuum steam heating system. Illinois Engineering Co., Div. of American Air Filter Co., Inc.

263—Woven Electric Heaters

Pre-Fab woven electric heaters are described in folder 1548 which illustrates typical uses and gives application data for this versatile heat source. Suggested uses such as for heating gearboxes, local comfort heating, and for preventing condensation are listed. Pre-Fab Heater Co., subsidiary of Edwin L. Wiegand Co.

BOILERS & STEAM

264—Vertical Unit Boiler

More than 25 years of development, manufacturing, and application experience are reflected in the design of the Type VU-10 vertical-unit boiler described in 16-page bulletin VU 10-8. Advantages and design features are discussed. Combustion Engineering, Inc.

265—Refuse and Wood Burning

Engineering data concerning spreader stokers installed to burn refuse or wood are contained in 24-page booklet 505. Stationary, manual dumping, power dumping, and traveling grate installations having maximum capacities from 10,000 to 275,000 lb steam per hr, steam or compressed air operated, are described. Detroit Stoker Co.

266—General Catalog

A wealth of research, engineering, and manufacturing experience, gained since the founding of this company in 1880, is incorporated in the products described in four-page folder. Steam generators, heat transfer equipment, pressure vessels, valves, and fittings are shown. Henry Vogt Machine Co.

267—Pressure Equipment

One of the country's oldest manufacturers of equipment and accessories for plants piping steam, air, and gas under pressure, has published catalog 400, covering its line of separators, traps, and boiler trim. A condensation of the information in catalogs 500, 600, and 700, the booklet gives technical data. Wright-Austin Co.

268—Boiler Replacement

"What Every Business Man Should Know About Boilers," has been prepared to give executives a better understanding of boilers and a realization of the tremendous loss that industry is taking due to obsolete and inefficient steam generating equipment. Chances are two to one that your boiler is obsolete, according to this 14-page booklet. Superior Combustion Industries, Inc.

269—Coal-Burning Installation

"Burning Bituminous Coal the Modern Way," contains 24-pages of case histories from industries of all sizes and types. Engineering survey results for equipment such as boilers, stokers, coal and ash handling units, and automatic controls, include annual fuel consumption and operating costs. Bituminous Coal Institute.

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NOTE—Each bulletin has a key number for your convenience in asking for a free, personal copy. Circle key numbers on Reply Card between pages 34/35 & 90/91.

270—Draft Inducers

The biggest contribution to the cause of improved furnace operation in recent years has been the mechanical draft inducer, according to 12-page booklet I-52. Six causes of poor chimney draft are listed. L. J. Wing Mfg. Co.

271—Liquid Level Indicator

Do you have to guess at your boiler water level? Nineteen-page booklet WG 1824 describes the Yarway Remote Liquid Level Indicator and shows how it is used not only for boiler water indication but for feed water and deaerating heaters, expansion tanks, hot flow softeners, and other similar uses. Yarnall-Waring Co.

272—Packaged Steam Generators

Construction of packaged steam generators is described in eight-page bulletin 1060. Auxiliary equipment is listed and a blueprint with dimensions of a typical boiler room is given. Ames Iron Works.

273—Coal Handling Equipment

Applications of coal handling equipment for the power plant, pictured in 40-page brochure 2410, illustrates the cumulative experience gained in thousands of installations over more than 75 years. Drawings show tested layouts for various operating conditions. Link-Belt Co.

274—Tube Cleaners

Bulletin 43 introduces a new geared tube cleaner for removing scale in heat exchanger and condenser tubes of ⅝ to 2½ in. ID. The unit is said to be particularly effective where conditions require low speed and extreme power. The Airetool Manufacturing Co.

275—Boiler Gaskets

Easy-reference flange gasket and boiler gasket dimension tables and bolting data are included in catalog AG-953. Shown are types for raised face, smooth face, crane-lap, and Van Stone joints, flange unions, male and female joints, and tongue and groove fittings for all standard makes of boilers. United States Gasket Co.

276—Condenser Tube Inserts

How to restore leaking condenser tubes to service by sealing off the deteriorated portion with inserts, is the subject of four-page leaflet 500. Tube cleaners, expanders, and maintenance tools are listed. Thomas C. Wilson, Inc.

277—Boiler Cleaning

Four fact-filled pamphlets explain how this company's products will help you solve algae problems, increase boiler efficiency with use of the Ever Clean boiler process, remove rust, and prevent corrosion. North American Mogul Products.

278—Boilers and Equipment

Sixteen-page bulletin SB-50, "Erie City Boilers and Allied Equipment," describes custom designed steam generators for central station or industrial application. A number of water tube types available as well as a line of fire tube waste heat units are pictured. Erie City Iron Works.

279—Flue Dampers

Booklet 1-HEA on curtain type dampers for flue gas control explains what the damper is and does, construction, dimensions, installations, and gives case histories. Booklet shows drawings and photos of a variety of damper types. Heacon, Inc.

280—Tube Expanders

Rolling and flaring tube expanders and operating accessories are listed in eight-

Install Norblo

to be sure you have worry-free 'round the clock

Automatic Dust Collection

Automatic bag cleaning

No down time

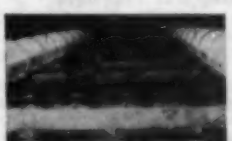
Low, easy maintenance

Norblo builds its own blowers in a wide range of capacities.

Norblo also builds centrifugal and hydraulic dust collectors, exhaust fans, cement air cooling systems, and portable type dust collectors.

You can have continuous dust and fume collection at full rated capacity without a worry about maintenance down time. Norblo automatic bag type dust arresters handle heavy loads by faithfully maintaining a constant suction drop across the arrester. Compressed air shakers coupled with air reversal action assure efficient bag cleaning, one compartment at a time.

Norblo engineers the complete installation with ample capacity for your needs, with wide adjustability and all the safeguards you may need. Few moving parts combined with a fully coordinated functional design result in very high efficiency, low cost of operation and maintenance. It will pay you to have Norblo engineers study your requirements. Write for Bulletin 164-4.



Each group of 39 bags has its individual compressed air shaker.

The Norblo Variable Electronic Timer governs the shaking and cleaning cycle.

Any compartment may be cut out of the operation and inspected through access door.

The Northern Blower Company

Engineered Dust Collection Systems for All Industries

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bulletins

—Starts on page 92

page catalog 68. Illustrations, specifications, and recommendations are included. The Gustav Wiedeke Co.

281—Atomizing Oil Burners

The cheapest grades of oil or tar can be completely atomized and efficiently burned with Type SA steam atomizing oil burners according to 16-page bulletin 21. Models for various special uses are described. Furnace design and construction for efficient operation is stressed. National Airoil Burner Co., Inc.

282—Soot Blowers

Bulletin 1137 gives complete information on the Model G9B blower which employs a fixed position rotating element to clean a large number of tubes by sweeping through a pre-determined arc. The bulletin suggests various uses. Diamond Power Specialty Corp.

283—Heavy-Oil Burner

Fuel savings is the theme of eight-page foldout AD1131 which describes the new "4" Hev-E-Oil burner. Illustrations show compactness and simplicity of design. Cleaver-Brooks Co.

284—Packaged Steam Generators

Basic construction and design features of plant assembled steam generators, with or without superheat, are presented in illustrated 20-page booklet P6-51-2. Includes tables of engineering specifications for units from 10,000 to 30,000 lb steam per hr and design pressures from 280 to 825 psi. Foster Wheeler Corp.

285—Boiler Baffles

"More Steam from Your Boilers," a four-page folder, explains how streamlined baffles are applied to all types and sizes of boilers. Drawings indicate how they are installed in units to secure crossflow of gases. The Engineer Co.

286—Automatic Burner

Newly designed automatic burner, model PK-54, for oil, gas, and oil or gas, is described in four-page folder 430. For capacities to 42,000 lb steam per hr, the burner is described as a complete, automatic combustion unit including blower and controls. Peabody Engineering Corp.

287—Boiler Service Valves

Surface blow, bottom blow-off, water column blow-off, and connections are covered in 23-page bulletin E128, with complete specifications, materials, and dimensions of each type. Valve operation is explained by illustration. Fire protection valves are included. Everlasting Valve Co.

288—Boilers & Stokers

Over 86 years experience are embodied in the design and construction of Scotch Marine type portable boilers says 36-page catalog. Photographs and cross-sections illustrate various models ranging in capacities from 6 hp up to 25 hp. Underfeed stokers for this type boiler are described. The James Leffel & Co.

289—Firing Equipment

Over 50 years of leadership in the manufacture of industrial-commercial firing equipment is reflected in 19-page general catalog 3048. Schematic drawings, layouts of typical installations, cutaway views of burners and burner parts, and photographs are included. Petro Division.

290—Combustion Processes

Too much or too little air can have costly effects in combustion processes. Bulletin "Oxygen-Index of Combustion Processes" points out that by using oxygen itself as the criterion to proper combustion, greater over-all efficiency, and economy are realized. Arnold O. Beckman, Inc.

291—Oil & Gas Burners

Advantages of preassembled oil, gas and combination oil and gas burners are listed in 8-page bulletin P-182. The units contain all necessary control equipment, and require only mounting to furnace and service connections. Units in sizes from 30 to 900 hp are listed for four common gas pressures and all grades of oil. Coen Co.

292—Package Boiler Controls

Specifications for the fully automatic, all electric metering type packaged control for shop assembled boilers are given in four-page bulletin 54-1088-239. Schematic drawing shows a typical packaged control system for a combination oil or gas fired boiler. The Hays Corp.

294—Medium Range Boilers

Information on operation and specifications of Type 1, Type 2, and Type 3 packaged boilers built to meet steam requirements in the medium pressure range, from 4100 to 30,000 lbs of steam per hr, is included in nine-page booklet WT-7. Engineering data and photos are included. Wm. Bros Boiler & Mfg. Co.

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295—Remote Reading Gages

Eight-page catalog 248 covers in detail the three standard types of Convex Scale and Flat Scale Truscale Remote Reading Gages, showing how these gages bring liquid level indication down to where it can be seen easily—protecting valuable equipment and preventing expensive shutdowns. Jerguson Gage & Valve Co.

296—Check Your Steam Costs

"Have You Checked Your Steam Costs Lately?" This 15-page handbook is a non-technical presentation of vital interest to everyone considering merits of replacing existing boiler equipment or considering purchase of new boiler equipment for a new operation. Orr & Sembower, Inc.

297—Spinning Gas Technique

Operation and advantages of the Continental Automatic Boiler's "spinning gas technique," a method of obtaining maximum heat transfer with a simplified design, is explained in four-page booklet BE-4. A cut-away view of one of these packaged boilers shows method of injecting the air and other features. Boiler Engineering & Supply Co., Inc.

298—Heavy-Oil Burners

Belt driven horizontal rotary type heavy-oil burners, available in forty combinations of control, ignition, shut-off, and type are described in eight-page booklet 175-H. The newly-developed equalizing valve which is said to improve automatic starts on No. 6 oil is shown in schematic illustrations and phantom view. Preferred Utilities Corp.

BUILDING MATERIALS & MAINTENANCE

299—Thread Compound

A data sheet gives complete information on C-5 "Hi-Temp" thread compound. A sample will be sent along with the data sheet. Felt Products Manufacturing Co.

300—Flooring

"Handbook of Building Maintenance," gives valuable information on keeping your plant in efficient working order. Instant-Use concrete floor patch is described with suggestions for its use, along with data on other materials for repairing floors. Flexrock Company.

301—Repair Cements

Text and illustration in this 48-page handbook present repair methods for leaks in pipes, boilers, radiators, concrete, cinderblocks, and sheet and plate metal. Directory describes 12 repair cements and jobs they will do. Smooth-On Mfg. Co.

302—Cutting Maintenance Costs

Installation pictures and stories in this publication known as "Industrial News," will show you ways of cutting your maintenance costs or increasing production through the use of this company's industrial rubber products. Gates Rubber Co.

COMPRESSORS & BLOWERS

303—Compressors

Horizontal heavy duty air and gas compressors, Type T, are described in 15-page bulletin 728-8. Cross sections of crankshaft, inlet valve unloading system, compressor cylinder and valves, and the complete compressor add to the value of the booklet. Chicago Pneumatic Tool Co.

304—Rotary Compressors

Operation and construction of single-stage water-cooled rotary compressors and vacuum pumps, applicable to every air or gas handling requirement, are described in 12-page bulletin 16B8126. It gives general specifications along with typical air piping diagrams. Allis-Chalmers Mfg. Co.

CORROSION CONTROL

305—Transmission Line Corrosion

"Corrosion Control of Electrical Structures and Equipment," 17-pages, is designed to give practical painting information on all phases of transmission and distribution work. Subox, Inc.

DIESEL & GAS ENGINES

306—Dual Fuel Engines

In 36-page bulletin S-500-B757 are photographic examples of each application, together with vital statistics, case histories, and comments on fuel consumption for dual fuel engines. Each feature is treated separately. Worthington Corp.

ELECTRICAL DISTRIBUTION

307—Air Circuit Breakers

Bulletin 5107-DR-1 contains four pages of facts, figures, features, and photographs on types KA, KB, KC, and LG Urelite air circuit breakers, and on weatherproof and dust-tight enclosures. I-T-E Circuit Breaker Co.

308—Power Transformers

Power transformers being built at the new mass production Rome, Ga. plant are described in 40-page booklet GEA-6108. It cites applications and features of standardized single phase and three phase units, ranging from 501 to 10,000 kva. General Electric Co.

309—Dry-Type Transformers

"Latest Developments in Dry-Type Transformers," seven-page catalog 153-A, presents the advantages of air-cooled units designed and constructed primarily for inside installations. Sorgel Electric Co.

310—Renewable Fuses

Sixteen-page bulletin S-40 describes the Economy DeLay renewable fuses which are said to give safe and dependable time-delay on overloads. For every requirement, these fuses have inexpensive links which are easily replaced. Economy Fuse & Manufacturing Co.

311—Power Factor Correction

Booklet 50B, 27 pages, describes the Unit-Cell Box Type Capacitors which offer easy-to-install, economical means of correcting low power factor for large or small power consumers. Typical wire connections are shown. Sprague Electric Co.

312—Circuit Breakers

"What You Should Know About Circuit Breakers," 16-page manual 101, explains the operating principles of basic circuit breaker design. Included are simplified diagrams of three basic types. Heinemann Electric Co.

313—Commutators and Slip Rings

"Commutator and Slip Ring Maintenance," 39-page handbook, covers trouble shooting, brush maintenance and operating procedure, and general maintenance. Illustrations show the operations described. Ideal Industries, Inc.

314—Light Dimming Equipment

Light dimming equipment, available as packaged assemblies, is the subject of 12-page bulletin D651P. Described are units for different numbers of circuits requiring up to 2000 w each, and for various types of a-c operation. Wiring diagrams are included. The Superior Electric Co.

315—Flexible Conduit

Extra flexible Sealtite conduit for electrical wiring of machine tools and industrial equipment is pictured and described in four-page pamphlet EF-531. It points out the fact that this liquid-tight, extra flexible conduit is approved for these uses by the Joint Industry Council. American Metal Hose Branch, American Brass Co.

ELECTRIC UTILIZATION

317—Variable Speed Motors

How variable speed motors are used to improve production is described in 16-page brochure 1797. In addition to describing advantages the booklet describes design theory and construction features. U. S. Electrical Motors, Inc.

318—Motor Control Center

Savings in space and expense and improved performance is explained in 12-page bulletin 170. Electrical and constructional details of these groups of combination motor starters and their components are fully described. Arrow-Hart & Hegeman Electric Co.

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Part malleable iron, part bronze alloy, Darts have the advantages of all-brass unions, without the disadvantage of stretching. They have the advantages of all-iron unions without the disadvantage of rusted or pitted seats. They're easy and fast to install, give a drop-tight fit, and can be taken off and used over and over again. You can't buy more for your union money!

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bulletins

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319—Motors

Advantages of the various types of motors made by this company are given in four-page folder 23. Descriptions of single-phase and polyphase motors are included along with a listing of their specifications. Wagner Electric Corp.

HEAT EXCHANGERS & WATER HEATERS

320—Pipe and Fin Coils

Revised second edition of the "Engineering Data Book on Pipe and Fin Coils" contains such information as calculation of pipe and fin coils, heat transfer coefficients for heating or cooling, and Btu load limitations for cooling coil circuits. Rempe Co.

321—Injection Water Heaters

Steam injection water heaters with the pressurizer piston for safe, quiet, automatic control are described in four-page pamphlet WH12A. How the unit saves space, time, fuel, and maintenance costs is explained. Pick Manufacturing Co.

322—Water Heaters

A streamlined system of heating water and process liquids quickly and at low cost is explained in this bulletin. The Instant Heater described eliminates the need for reducers. Cross-sectional drawings explain how unit operates. Johnson Corp.

323—Heaters

Horizontal and vertical heaters in steel, copper lined, copper-silicon, cement lined, clad and galvanized construction, as well as the low-flow design are each cataloged as to weights, dimensions, construction details, and capacities—with conversion tables, in 48-page catalog 18. The Patterson-Kelley Co., Inc.

INSTRUMENTS & CONTROLS

324—Gage Catalog

The four important questions to ask before you buy gages are listed in comprehensive 68-page catalog 64. Whether you need gages for replacement on operating equipment or for installation on new equipment, you will find complete information in this booklet. U.S. Gauge Div., American Machine and Metals, Inc.

325—Temperature Regulators

Bulletin 330 fully describes a simple, self-operating temperature regulator for plating, anodizing, bonderizing, pickling, cleaning and rinsing solutions. The Powers Regulator Co.

326—Temperature Regulators

Recommended installations of temperature regulators for instantaneous water heaters, storage water heaters, and forced air heating systems are shown in three line drawings in four-page folder 1008. Spence Engineering Co., Inc.

327—Temperature and Pressure Control

Through years of experience in instrument design and manufacture, this company has developed a specialized line of equipment for the recording and indicating of temperature and pressure. Seven-page bulletin G-158-A shows typical examples of such equipment with lists of specifications. The Electric Auto-Lite Co., Instruments and Gauge Div.

328—Flow Meters

With an alarm control, the flow meters described in this bulletin have only three moving parts. How they operate to ring a bell, light a light, or activate a motorized valve is explained by means of illustrations. Henszey Co.

LUBRICATION

329—Force Feed Lubricator

Automatic force feed lubricator Model "94" described in 11-page booklet 94-C will pump against any steam or air pressure up to 1500 lb and will handle any grade of oil from the lightest mineral to the heaviest cylinder stock. Manzel Div. of Frontier Industries.

330—Non-Fluid Oil

This instruction bulletin explains the uses and advantages of Non-Fluid Oil. According to this booklet, it cannot clog fittings, it lubricates until entirely consumed, and will not separate under pressure. A free testing sample of the oil will be sent with the literature. New York & New Jersey Lubricant Co.

331—Diesel Lubrication

Written for everyone interested in the lubrication of diesels, "Lubrication of Diesel Engines," has been revised as technical bulletin B-1, 48-pages. It discusses diesel principles and design, types of engines in use, operating cycles, accessories and choice of correct diesel lubricants. Sun Oil Co.

332—Industrial Gear Lubricants

The new and improved line of extreme pressure industrial gear lubricants to replace Stanogear Leaded Lubricants and Stanogear EP Lubricants is discussed in six-page technical bulletin X-417. Every engineer with lubrication problems should have this booklet as general reference material. Standard Oil Co. (Indiana)

333—Bearing Lubrication

"Industrial Bearing Lubrication," is a reprint from the magazine **Lubrication**, October, 1954 issue. The article covers bearing design, surface, overhaul, and aspects of lubrication. The Texas Co.

MATERIALS HANDLING & STORAGE

334—Storage Bins

If you specify vertical storage construction for handling flowable bulk materials, this ten-page foldout will help you visualize how this company's Super-Concrete Stave Storage Bins might meet your requirements. The Neff & Fry Co.

METALS & WELDING

335—Nickel Alloys

Helpful technical publications covering the many aspects of nickel alloys, and their applications, are listed in two bulletins. Instructions on how to order literature, free of charge, are included. The International Nickel Co., Inc.

PIPING, VALVES, & SPECIALTIES

336—Valves

Needle, globe, plug, check, relief, and special valves are described in 44-page

NON-FLUID OIL
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KEEPS MOTORS HUMMING

NON-FLUID OIL keeps electric motors humming in tip-top shape because *it stays where put* — providing better lubrication at less cost per month, per year. Motors run longer, cooler, and cleaner with NON-FLUID OIL.

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catalog 332A. Units listed are made of various metals, and are suitable for instrumentation, processing industries, hydraulic systems, and industrial applications. Republic Manufacturing Co.

337—High and Low Pressure Valves

Catalog 10 describes List 900 and 990 valves. The 900 is for a pressure range of 200 lb at 100 F to 380 lb at 1000 F. The 990 is for higher pressures. According to the booklet, these valves offer extra protection against excessive stress. Chapman Valve Manufacturing Co.

338—Regulating Valves

Bulletin 1-A, 52 pages, gives complete information on a wide range of regulating valves for steam, water, air, gas, or oil. Illustrations, cross-sectional drawings, and specifications are included. Atlas Valve Co.

339—Prefabricated Conduit System

Introduced in four-page folder 5210 is a newly developed large diameter, prefabricated conduit system for protection of underground services. Prefabricated to job requirements, it contains piping for steam, condensate, water lines, fire lines, or process purposes all in place and insulated where required. The Ric-wiL Co.

340—Trapping Practice

Engineers concerned with steam traps should find 48-page catalog J a valuable source of data on recommended trapping practice. A maintenance section covers installation, preventive maintenance, trouble shooting, and repair. Armstrong Machine Works.

TO REQUEST FREE BULLETINS
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341—Tank Calculator

Hydro-pneumatic tank calculator tells you instantly the best air-water ratio, most efficient pressure differential, exact amount withdrawn on any pressure drop, and resultant reserve. Printed on heavy board, the calculator operates on a side rule principle. Automatic Control Co.

342—Pump Valves

Pump valves and graphite packings are described in 24-page brochure SC-510. Types, details of construction, design features, applications, how to order, and dimensions are included. Heaters for heating water by blending with steam are also presented. Sims Pump Valve Co., Inc.

343—Float Traps

If you are planning to install low, medium, or high pressure float or float and thermostatic traps, you will need this illustrated catalog sheet. According to the data sheet, once these valves are installed, there is no necessity for the breaking of any pipe connection for servicing. Hoffman Specialty Manufacturing Corp.

344—Welded Floats

Units made of stainless steel, Monel, and chrome plated steel, in spherical, eliptical, and cylindrical shapes are shown in eight-page bulletin 753. Sizes from 2 to 14 in. dia for pressures from vacuum to 4800 psi are listed with weights, buoyancies, and collapsing pressures. W. H. Nicholson & Co.

Torque Wrenches

Both inch-pound and foot-pound torquers are described in this complete 68-page catalog. Types included are for a wide range of drive sizes with plain or ratchet head. **Please send requests directly to Proto Tool Co., Dept. IP, 22762 Santa Fe Ave., Los Angeles 54, Calif., with 10c.**

345—Rubber Linings

Application of rubber lining to prevent corrosion of tanks, pipes, and valves is discussed and pictured in four-page folder. In addition, two-page reprint tells how rubber lining can stop circulating pipe corrosion. La Favorite Rubber Mfg. Co.

346—Tips for Valve Users

"Technical Tips," four-page bulletin 542 describes and illustrates data gathered by this company's laboratories on valve material installation and usage. Many of the tests described were the direct result of inquiries or requests from customers. Edward Valves, Inc., subs. of Rockwell Mfg. Co.

347—Hand Threading Pipe

"Helpful Hints on Hand Threading Stainless Steel Pipe and Tubing," data card TDC-147, discusses die stock, dies, speed, cutting oils, and the assembly of threaded joints. It is intended to assist pipe fitters working with hand tools on job sites or in provisional field shops. Tubular Products Div., Babcock & Wilcox Co.

348—Packings and Gaskets

"Chempac Packings & Gaskets," six-page folder, gives pertinent information on each of the several types and on solid Teflon sheets. These packings and gaskets are especially designed for chemical and process equipment. Johns-Manville.

POWER TRANSMISSIONS — MECHANICAL

349—Belt Conveyor Design

Engineering data required to design a belt conveyor for any application are presented in 96-page catalog 852. The booklet, published to serve as a handbook on conveyor design, states that many problems can be answered by using a standardized unit. The Jeffrey Mfg. Co.

350—Flexible Couplings

Flexible couplings which never require lubrication are shown in 19-page bulletin 1009. Valuable engineering data for each type of coupling are given in table form. Lovejoy Flexible Coupling Co.

351—Eddy-Current Machinery

"Basic Principles of Eddy-Current Machinery," a section of 15-page bulletin GBI, explains the fundamental principles of generating torque by means of eddy-current devices. Another section, "Characteristics of Rotating Equipment," contains engineering data. Dynamatic Corp.

352—Rayon Belting

Transmission belting with rayon instead of cotton plies was proved in field applications for more than four years on jobs specially selected for their severity according to four-page folder A5163W. Goodyear Tire & Rubber Co.

353—Steel Collars

Steel shaft collars are shown in use on industrial lift trucks, printing presses, textile machinery, and other industrial equipment. Advantages of this type of collar are listed and a specification table is included. Standard Pressed Steel Co.

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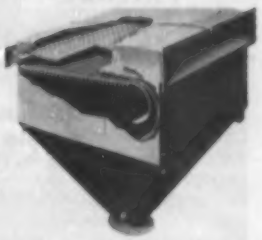

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bulletins

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354—Chains and Sprockets

Catalog 950, 340-pages, with its flexible cover and thumb index will prove to be invaluable to the engineer interested in chains and sprockets for conveying, elevating, and power transmission. Tables of pre-engineered drives facilitate selection of standard roller chain drives and silent chain drives. Link-Belt Co.

355—Poly-V Drive

Design characteristics of the Poly-V drive, a single, endless belt with molded length-wise ribs, are explained in eight-page folder 0638. Line drawings and text compare the Poly-V with conventional drives and point out advantages. Manhattan-Rubber Div., Raybestos-Manhattan.

356—Centrifugal Clutch Coupling

Eight-page bulletin CE-3 explains the 11 new important features of the Twiflex flexible automatic centrifugal clutch coupling. This is not just a catalog, but a collection of valuable engineering data on this type of coupling. The Hilliard Corp.

PUMPS

357—Turbo Pump

Each component of the type DE turbo pump is pictured and its design advantages explained in a six-page folder. The lubrication system is also described in detail. Typical uses are listed. The J. S. Coffin, Jr., Co.

358—Proportioning Pumps

Design of the "K" pump, the result of long experience in the solution of proportioning problems, is shown in detail by means of a two-page foldout in five-page bulletin KP-54. Capacity and pressure tables will help you choose pump for your requirements. Hills-McCanna Co.

359—Opposed Impeller Pump

How opposed impellers balance axial thrust is covered in 12-page brochure 1502. Sizes from 2 to 4 in., with 2 to 8 stages, are presented for capacities to 1000 gpm, pressures to 1200 psig, and temperatures to 350 F. DeLaval Steam Turbine Co.

360—Packings

Darcova pumcups, which permit equipment to be operated at reduced speeds, are described in two bulletins: No. 4502 on Pumcups for air or hydraulic mechanisms; and 4401 on units for reciprocating pumps. Darling Valve & Mfg. Co.

361—Non-Clogging Pumps

Type U non-clogging pumps designed for handling liquids carrying large amounts of solids and foreign materials are described in 11-page bulletin 730-C. The specific uses of each type pump are given along with tables to help in selection. Weinman Pump Manufacturing Co.

362—Plunger Pumps

Graphically illustrated by photos, charts, and line drawings, 11-page bulletin W-44-B45 contains information about the VTE, VTE-1, and VTE-2 types of Plunger Pumps. Units are designed for application in fields such as the petroleum industry, flooding, and salt water disposal. Worthington Corp.

363—Pumps

Condensed catalog "M" describes pumps for every purpose. Among those described are: turbine type pumps for use with small capacities and high heads; and type 66U side suction centrifugal pumps. Aurora Pump Div. of New York Air Brake Co.

364—Package Feeder

Proportioning pumps and package chemical feeding units are described in this four-page folder. With liquid ends available for about 85 percent of all chemical pumping requirements, the pump is designed for use where a controlled capacity is necessary. Bird-Archer Co.

365—Rotary Gear Pumps

"How to Solve Pumping Problems," is the title of 36-page booklet 3060. In addition to presenting typical problems and their solutions, various types of rotary gear pumps are described. The major portion of the book is intended to serve as a data handbook. Geo. D. Roper Corp.

366—Pump Valves

Pump valves and graphite packings are described in 24-page brochure SC-510. Types, details of construction, design features, applications, how to order, and dimensions are included. Heaters for heating water by blending with steam are also presented. Sims Pump Valve Co., Inc.

REFRACTORIES & INSULATION

367—Refractories

Charts which show at a glance the properties of refractory castables, plastics and mortars are featured in 20-page catalog R-22. Important information including recommendations for each is presented. Babcock and Wilcox Co., Refractories Div.

368—Refractories & Insulation

Catalogs R-52 through L-93, compiled in a binder form an illustrated 40-page booklet showing where, when, and how to use various types of materials for industrial heat generation and processing equipment. Refractory & Insulation Corp.

369—Industrial Insulation

"J-M Products for the Process Industries," eight pages, is arranged as a ready reference for men responsible for the design, installation, and operation of process equipment. Johns-Manville Corp.

370—Aluminum Jacketing

One of the most frequent problems in the use of aluminum jacketing on insulated lines is how ells, tees, and bends should be weatherproofed. Data Sheet E-130 presents three practical methods. Childers Manufacturing Co.

371—Refractory Concrete

"Refractory Concrete Manual," 16-pages, covers basic information on recommended practice for mixing and placing refractory concrete. Charts and tables put important technical data in a convenient form for easy reference. Lumnite Div., Universal Atlas Cement Co.

TURBINES & STEAM ENGINES

372—Low-Cost Power

If you use steam for heating, cooking, or processing, you can get power at almost no cost with the use of a Wing steam turbine according to bulletin SW-1a. Construction of these units gives an almost infinite range of speeds, easy control by throttling, and the units are independent of any electric power failure. L. J. Wing Mfg. Co.

373—Steam Turbines

Fully-illustrated 24-page bulletin 1961 emphasizes the flexibility of design of the Type-S turbine which is said to make possible selection of the proper number of stages, governor, and controls to give maximum efficiency for your steam and operating conditions. Worthington Corp.

374—Multi-Stage Turbines

Smaller framed, multi-stage turbines are featured in six-page bulletin. Overspeed governor, governor valves, blades, diaphragms, and many other design features are discussed and illustrated. The Terry Steam Turbine Co.

375—Turbine Speed Control

"Fundamentals of Turbine Speed Control," 32-page brochure H-21, is an educational piece intended to clarify the operation of common types of automatic speed control for steam turbines. Simplified diagrams illustrate operating principles of actual control systems. Elliott Co.

376—Steam Turbine Selection

Full details of this company's steam turbine are given in bulletin 135. Drawings and installation photographs point out the special features. How to save operating and maintenance costs by buying the right size for individual needs is explained. Coppus Engineering Corp.

WASTE DISPOSAL

377—Waste Treatment

How this company has solved waste treatment problems for such industries as electro-plating, refinery, gas, and metal finishing is treated in detail in six-page booklet 70-B. A handy bibliography serves as a reference for more information. Infilco, Inc.

WATER TREATMENT

378—Water Analysis

Published by a company engaged exclusively in the solution of industrial water conditioning problems, this 14-page brochure contains brief descriptions of testing and control equipment necessary for the more common water analyses. W. H. & L. D. Betz.

379—Water Purification

"Boiler Feedwater Treatment," 19-page bulletin BFT-1, covers Inversand zeolite softeners, color process chemical softeners, and demineralizing units, including silica removal by ion-exchange by means of chemical formulas and flow diagrams. Hungerford & Terry, Inc.

380—Ion Exchangers

Strongly basic anion exchanger is presented in 16-page bulletin 57. Includes complete data on physical characteristics, exchange capacity and regeneration technique. National Aluminate Corp.

381—Mixed Bed Demineralizing

"Automatic Mixed-Bed Demineralizing at the Albany Steam Plant," eight-page bulletin 3983 tells the story of the first fully automatic mixed-bed equipment to produce make-up water. A table shows the comparative cost of an evaporator and a demineralizer. The Permutit Co.

382—Water Softener

ZEO-FLO Sodium Zeolite Softener, a water softener specially designed for small and medium size industrial plants, laundries, and hospitals, is described in four-page folder 4505-A. How the softener has been simplified so that installation may be handled readily by the facilities of a small or medium sized plant is explained. Cochrane Corp.

383—pH Control

"Automatic pH Control in Water and Industrial Waste Treatment," eight pages, is a reissue of a paper delivered by R. T. Sheen, president of this company. Outlined are several typical systems of automatic pH control in boiler feed water treatment. Milton Roy Co.

TO REQUEST FREE BULLETINS
Circle "key" numbers on Reply Card between pages 34/35 & 90/91. Your requests will be handled promptly.

384—Chlorinizers

Chlorination—the modern way to prevent slime buildup in condensers and heat exchangers—saves you money if its right. But if dosage is too heavy, you run the risk of corrosion, according to application memo 840-J9. Chlorinizers for feeding from a few pounds to 6000 pounds per day are described. Builders-Providence, Inc.

385—Demineralization

"Demineralization including Silica Removal by Ion Exchange," 28-page booklet 3803, describes applications, principles of operation, and gives recommendations for demineralizing and silica removal apparatus and synthetic resins. The Permutit Co.

386—Boiler Water Treatment

Difficulties caused through industrial water contamination are outlined in a 12-page catalog. Recommended water conditioning treatments for scale, sludge, corrosion, carryover and other boiler conditions, and efficient control methods are described. E. F. Drew & Co., Inc.

387—Deaerators

Spray-atomizing type units are shown in cross-section in four-page booklet 400. Function, design and operation, construction, outstanding features, and uses are discussed. American Water Softener Co.

388—Boiler Water Foam

Laboratory pictures in this four-page folder show how Concentrol controls boiler water foam. Examples of its use in various industries are given along with an explanation of foaming. Bird-Archer Co.

389—Filming Amine Protection

"Film Forming Corrosion Inhibitors Also Aid Heat Transfer," four-page technical paper No. 129 contains references to protection afforded by filming amines and attendant reduction in maintenance costs secured through protection against corrosion. W. H. & L. D. Betz.

390—Free Check-Up Service

SECA Report 50694 explains the service offered by this company whereby any make zeolite water softener will be checked by a field engineer, free of charge, and the results submitted to the owner of the equipment in exact figures and percentages showing just how efficient his equipment is, with recommendations of how to increase its usefulness. Elgin-Refinite, Div. of Elgin Softener Corp.

LA FAVORITE Expansion Joints

A typical grouping of the thousands of La Favorite Rubber Expansion Joints supplied for U. S. Navy vessels.
1 of 10,000 La Favorite Products
Any Type—Any Size

Round, Square, Rectangular, Oval, Taper and Special Shapes of rubber expansion joints compensate for linear expansion in piping; absorb vibration; reduce or eliminate transmission of undesirable noise; or connect misaligned piping without strain on the line—for years of economical service without attention.

For complete details, send for Bulletin 259-W.

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names make news

. . . personalities from industry and power

Kuyper Chase

General Electric Co. — **William Kuyper** is appointed manager-manufacturing engineering of the Large Steam Turbine-Generator Dept.

In the Small Turbine and Supercharger Dept., **Harold J. Chase** is appointed manager-engineering.

Lucas P. Hart, Jr. is appointed manager of manufacturing for the Capacitor Dept. at Hudson Falls, New York.

In the Distribution Assemblies Dept., **Harold C. Jenseth** is appointed plant manager of the San Francisco plant. He was formerly supervisor of engineering in the Seattle plant.

The Ric-wiL Co. appoints **William F. Wood** as general sales manager. Wood was formerly district manager in charge of the Washington, D. C. office.

Industrial Mineral Fiber Institute, Inc. — New officers are: **M. M. Wilson**, Baldwin-Hill Co., president and chairman of the board; **W. D. Myers, Jr.**, The Eagle-Picher Co., vice president; and **J. A. Corcoran, Jr.**, Forty-Eight Insulations, Inc., treasurer.

Morse Chain Co. has elected **Frank M. Hawley** as chairman of the board and **Stanley J. Roush** as president and general manager. Roush also continues as president of the Atkins Saw Div. of Borg-Warner Corp.

Minneapolis-Honeywell Regulator Co., Valve Div., names **Marshall B. Taft** as general manager to succeed **Stephen A. Keller.** Keller is named general manager of the new Heiland Div. in Denver.

Rockwell Manufacturing Co. — Paul **A. Manor** becomes chief engineer of the Barbertown, Ohio lubricated plug valve plant.

The Swartout Co., Ventilation Div. — **Alfred H. Mansbach** is appointed chief engineer to succeed the late **F. L. Rickmeyer.**

Westinghouse Electric Corp. has purchased all the capital stock of the **Schneider Manufacturing Corp.**, of Muncie, Ind., manufacturers of torque converters.

The Babcock & Wilcox Company's Boiler Div. announces appointment of **Nicholas C. Jessen** as assistant superintendent of Barberton, Ohio works.

Jessen Stickler

Henry Vogt Machine Co. — **Lee E. Stickler** joins the St. Louis office where he will represent the company in the steam generator, refrigeration, heat exchanger, and pressure vessel lines.

SIMS VALVES LAST LONGER IN ANY PUMP

Here's Why...

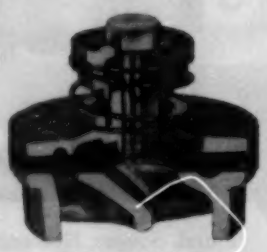
Stem breakage eliminated – by exclusive double shock-absorber stem heads.

Reduced wear - long guide gives even lift. Springs can't jam.

Smooth seating surface– rotating valve disc changes to new seating surface with every pump stroke.

Reduced flow resistance– accomplished by Sims inclined seat-ribs.

Sims Pump Valves, for all reciprocating pumps, are stocked for quick delivery.



Write for Bulletin IP-12 explaining how Sims Valves can improve your pump operation at lower cost.

Sims

PUMP VALVE CO., INC.

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M&M BLDG., HOUSTON, TEXAS

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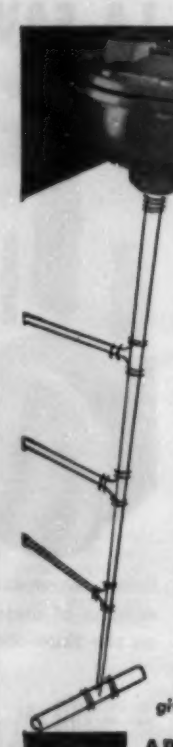

● IF YOU LIKE to install high quality accessories on your jobs then you will want to use Armstrong's No. 21 Air Relief Trap. This air vent is known for its simplicity and reliability. Valve seat is hardened chrome steel; valve, lever and ball float are corrosion resistant stainless steel; body is cast semi-steel.

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The Detroit Edison Co.—**Harold W. Collins**, general superintendent of Detroit Edison's electrical system, is promoted to the position of special assistant to the manager of engineering, **Howard P. Seelye. Delmar D. Chase** assumes Collins' former duties. **F. Clifford Pohl** is named assistant superintendent, and **Ernest W. Spring** becomes superintendent of electrical system equipment.

The American Society of Tool Engineers has chartered its 120th chapter at Benton Harbor—St. Joseph, Mich. Chairman of the new chapter is **Elmer Hopf** of Covel Manufacturing Co. Other officers are: first vice-chairman, **Allan Ashley**, Whirlpool Corp.; second vice-chairman, **Harold J. Neumann**, Bendix Aviation Corp.; secretary, **Ivan Peters**, Whirlpool Corp.; treasurer, **Virgil R. Ramsey**, Gast Mfg. Co.

American Potash & Chemical Corp.—**Joseph Adinoff** joins the company as chief engineer of the Eston Chemicals Div. at Los Angeles.

Prat-Daniel Corp. has acquired patents, sales, and manufacturing rights of Overhead Panelray, a gas-fired infra-red industrial and commercial heating device, developed by Day and Night Div. of Affiliated Gas Equipment, Inc.

Fenwal Inc. appoints **Raymond H. Matthews** as chief engineer. He will be in charge of twenty engineers and designers working on development of new instruments.

TOUR ALUMINUM-CLAD BUILDING

Foreign engineers inspect Worthington air conditioning equipment at aluminum-clad office building, 99 Park Ave., N. Y. L. to R.: Peter Singendonk, the Netherlands; Vicente Galfano, Chile; Peter Van Leeuwen, Netherlands; Jochanan Spitz, Israel. They are attending an air conditioning and refrigeration course at Worthington Corp.

Clark Equipment Company's Construction Machinery Div. appoints **Lowell Conrad** as director of engineering, and **Raymond H. Bowman** as chief engineer.

Johnston Pump Co. appoints **Charles J. Schleeweis** as sales manager in charge of the supervision of all domestic and foreign sales for the company's vertical turbine pumps.

Yarnall-Waring Co. appoints **John A. Steer** as sales manager of the Boiler Trim Div. Steer was formerly sales manager of the company's Philadelphia and New York districts.

Worthington Corp.—At the Buffalo Works, **Walter E. Max** is appointed general superintendent. **Harry P. Yount** replaces Max as manager of the Buffalo service and erection dept.

Chrysler Corp., Marine & Industrial Div.—**William A. Martin** is appointed works manager.

Byron Jackson Co. announces appointment of **Ross Barrett** as director of advertising and public relations, in line with the company's expansion in four fields: electronics, the foreign market, automatic production, and atomic power.

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New drive-in (off street) entrance & parking

Motel convenience

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FULL FLOW with minimum pressure drop.

ANY CONDITIONS of commercial, drip- or bubble-tight closure, with quick, positive control and shut-off manually or automatically.

RESISTANT Made ruggedly for all conditions of corrosion, erosion, temperatures to 2000° F., pressures to 300 p.s.i.

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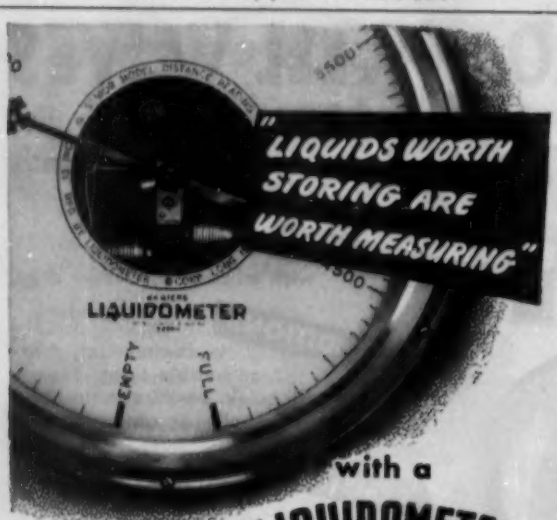

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ideas in action

—Starts on page 86

Larger, More Efficient Boilers Figure in Expansion Plans

In 1880 Thomas Edison signaled the start of central power stations in this country with the construction of the Pearl Street station for New York Edison Co. This station contained six bipolar generators with a capacity of 10,000 lights each. Only 14 ft high, the original Edison boiler required ten times as much fuel to generate a kw of electricity as do modern steam boilers.

In contrast to this, Babcock & Wilcox Co., which supplied the Pearl Street boiler, has recently erected a 12 story high boiler at San Diego Gas & Electric Company's Encina station in Carlsbad. It will operate at a steam pressure of 1450 lb per sq in. and 1000 F.

When completed, the new station will house four turbo-generating units with a capacity of 106,000 kw each. Pioneer Service & Engineering Co. of Chicago, consulting engineers on the project, expect the second unit to be installed in 1956, and the last two units at intervals of two to three years.

Even larger is the 215,000 kw turbo-generator to be added to the Glen Lyn Plant of the Appalachian Electric Power Co., American Gas & Electric Co. subsidiary.

The unit will be the sixth of a series of 215,000 kw or larger turbo-generators operating in the seven-state AGE system. This one unit will be capable of producing enough power to serve every home in a city of 1,200,000 population. Expected to produce a kwhr from about 7/10 lb of coal, it will operate at a steam pressure of 2000 lb per sq in. and at a temperature of 1050 F.

The latest in a series of modernization steps at Ford Motor Company's Rouge Plant is another boiler installation—one of the largest low-pressure steam units in industrial use. This seven story high Combustion Engineering boiler can produce up to 600,000 lb of steam per hr at 250 psig and 650 F. This is nearly double the hourly steam output of the old boiler.

Type of Fire Hazard Determines Choice of Protection System

Properly engineered fire protection systems are the result of knowing which type of protection will be most effective against the particular fire hazard present.

Combustible dusts, for instance, are a well known fire and explosion hazard. Materials that burn at a moderate rate when in large particle size will produce flash fires or even explosions when present in the air in finely divided particles. Dust lying dormant as on a floor, roof, or beam will smolder but if that same dust is stirred into a dust cloud, an explosion can result.

Fire engineers of Ansul Chemical Co., after conducting extensive fire protection tests on combustible dusts, have three suggestions for adequate control:

¶ Good housekeeping and elimination of dust collecting surfaces;

¶ Inerting dusty room interiors by discharging a dry chemical extinguisher into the room so that the chemical will settle over places where the dust may settle;

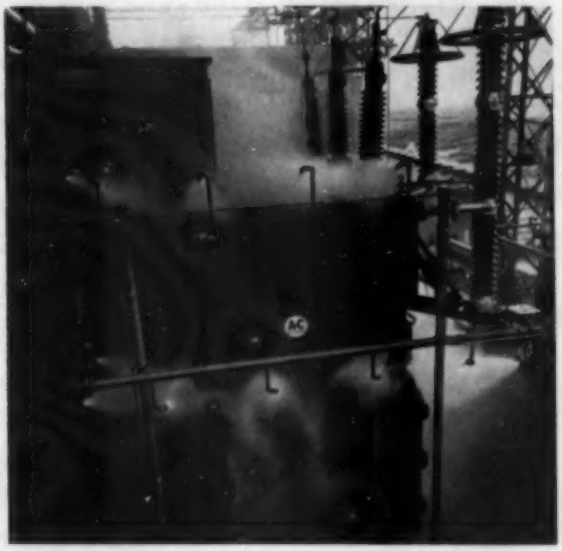
¶ The extinguishing agent used must be able to be applied so that dust clouds, which produce secondary explosions, are not formed;

¶ The agent must coat the dust particles so that unavoidable dust agitation will not result in an explosion. ¶ Water extinguishing equipment, if used, should be of a type that provides water in a fog or fine spray.

Factory Mutual Laboratories ran tests comparing the effectiveness of Ansul's dry chemical and talc in inerting atmospheres containing cornstarch. They found that a 20 lb dry chemical extinguisher would render 4000 cu ft inert, while 20 lb of talc would inert only 1300 cu ft.

An example of a water fog system is the installation at the Eastlake power plant of Cleveland Electric Illuminating Co. which protects a half-million dollars worth of transmission equipment. The transformers and circuit breakers contain over 14,000 gal of combustible oil.

The three identical water fog systems, designed by the Sprinkler Div., Blaw-Knox Co., operate automatically by means of rate of rise heat actuated devices.



Over 2200 gpm of lake water spray from 90 nozzles in this trial run to test efficiency of water fog system.

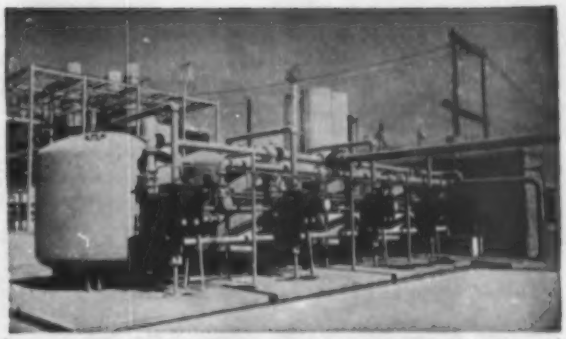
When temperature rise is 15 to 20 F per min, the devices open the deluge valve. The system can also be operated by switches in the turbine room.

Water from Lake Erie is drawn from station service water lines in which pressure is maintained at 175 psi.

Problem Locations Provide Testing Ground for Plastic Pipes

Combating pipeline corrosion is a continuous and costly battle. Plastic pipes and tubing, and even laminates are now being used in problem areas.

At International Harvester's sisal plantation at Cardenas, Cuba, a decorticator machine removes pulp and bark from the sisal leaves: the fiber that remains is used in the manufacture of cordage. Solid and liquid waste (bagasse water) is separated and the solid material trucked away in dump cars. A 1500 ft underground piping system carries the highly acidic liquid waste to the disposal pit. The high acid content precluded use of ferrous piping materials and wooden pipes rotted out so quickly that they meant a continuous maintenance headache. The solution was the same pipe



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Aluminum body for aircraft and general use, stainless steel for chemical, food, and dairy industries. Angle, 2, 3, 4-way, with or without drain, flanged for panel mounting.

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ideas in action

—Starts on page 98

that has found use in oil fields for lines handling sour crudes and salt water—Tenite butyrate plastic pipe.

Butyrate pipe was supplied by Crane Co., Chicago. Triangle Conduit & Cable Co. extruded the pipe from plastic marketed by Eastman Chemical Products, Inc.

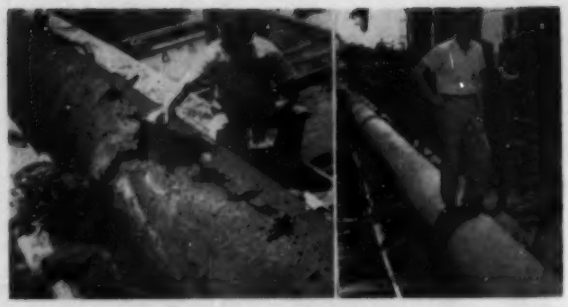
Tubing made of Geon vinyl resin, developed by B. F. Goodrich Chemical Co., is being used to protect instrument piping against both corrosive atmosphere and liquid handled at a film developing laboratory in this country.

The tubing connects a bulb, which is in a tank containing heated corrosive liquid, to a Foxboro Co. automatic temperature recorder.

In controlling temperatures, measurements are usually relayed by 1/16 in. OD copper capillary tubing, forming part of a sealed system in which the filling medium (gas, vapor, or liquid) expands in response to heat. To protect this tubing against accidental crimping or breaking, flexible bronze tubing is put over it. In this application the Geon plastic encases the bronze tubing.

The Bishop, Texas plant of Celanese Corporation of America, instead of replacing a badly corroded header pipe, rebuilt the corroded section with a laminate without moving pipe or disturbing the multiple connections.

Approximately 40 lineal feet of the header pipe had eroded, with large holes in some areas and the balance



Pipe had about 20 holes below water level and large hole in top. Repaired, pipe supports weight of man.

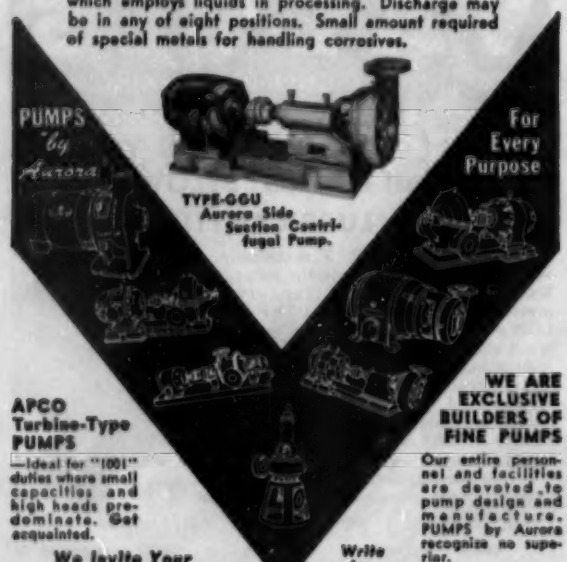
of the pipe rusted almost paper thin. There were some 20 holes below the water level of the pipe, which normally runs half full.

The repair procedure used was simple and effective. First, scale was knocked off and two plies of glass cloth, saturated with a self-curing blend of Celanese MR-28C Resin, were applied over the large holes. Leaks were then plugged and two additional plies of glass cloth, thoroughly saturated with the resin, were wrapped about the entire rusted area of the pipe, one at a time.

Total material costs amounted to $137.88 for the 30 gal of resin required. The laminate will not rust or rot and has a moisture absorption of less than one percent. If accidental rupture occurs, it will only be necessary to apply additional laminate to the damaged area.

Lasting Efficiency at Lower Cost

These GGU Pumps are in service in every industry which employs liquids in processing. Discharge may be in any of eight positions. Small amount required of special metals for handling corrosives.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meetings

. . . and exhibitions

Dec. 2-7	American Society of Mechanical Engineers (Power Show)	Commercial Museum Philadelphia, Pa.
Dec. 12-15	American Institute of Chemical Engineers (Annual Meeting)	Hotel Statler New York, N. Y.
Jan. 24-27	Plant Maintenance and Engineering Show (Exposition and Conf.)	Int'l Amphitheater Chicago, Ill.
Jan. 24-28	American Society of Heating and Vent. Engrs. (15th Int'l Exposition)	Commercial Museum Philadelphia, Pa.
Jan. 31-Feb. 4	American Institute of Electrical Engineers (Winter Meeting)	Hotel Statler New York, N.Y.
March 7-11	National Association of Corrosion Engineers (Annual Convention)	Palmer House Chicago, Ill.
March 14-18	American Society of Tool Engineers (Western Industrial Exposition)	Shrine Auditorium Los Angeles, Calif.

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"Demineralization . . . A Means To Purer Water"

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The reprints listed below are available for your personal reference files, free of charge. Write, preferably on your company letterhead to: Reader Service Department, INDUSTRY AND POWER, 420 Main Street, St. Joseph, Michigan.

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"Electric Drives Control Coal Feed to Dryers"
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"Combustion and Combustion Guides"
"Fundamental Designs of Industrial Condensers"
"Selection and Design Factors in Bus Duct Distribution Systems"
"Maintenance 'Know How' Means Efficient Batteries"
"Chrysler Centralizes Plant Utilities"
"Chemical Cleaning of Boilers"
"Mechanized Chip Handling"
"Profits From Wastes"
"Joining Copper and Its Alloys"
"Spreader Stokers"
"Piston Rings"
"Short Short-Circuit Calculations"
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"Upjohn's Mammoth Industrial Building . . . Completely Air Conditioned"
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"Lubricating Large Expensive Machines"
"Castables Simplify Refractory Applications"
"Dust Collection Alteration Effects A 33% Saving In Heat"
"Low Cost Auxiliary Power From Turbine Drives"
"Filtered Waste Water Reduces Cost"
"Modern System Moves 600 Ton Of Coal Per Hour"
"We Planned Our Power Plant's Growth"
"Television . . . The Eyes Of Industrial Control"
"Cooling System Layouts For Best Diesel Performance"
"Coal Burning Equipment"
"Oxidizing Catalyst"
"Boiler Blowdown Control"
"Electrical Determination of Endpoints For Ion Exchanger Runs"
"New Water Tube Package Boiler"
"Chrysler Wins Its War on Waste With Colloidair Separators"
"Cathodic Protection For Industrial Plants"
"Synchronous Motors Do Two Jobs"
"When to Use Eddy Current Couplings"
"Boiler Houses Are Not Necessary Evils"
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"What Moisture Resistance Means in Cable Insulation"
"Selecting Corrugated Expansion Joints"
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"Harbor Plant Pioneers in Pneumatic Build-Up of Refractory"
"Synchrotie Drives In Process Industries"
"Thermocouple Data"
"Pharmaceutical Plant Engineering Staff Meets Demand For Doubling Production"
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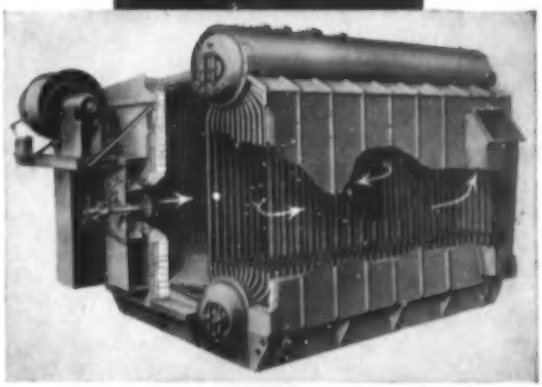

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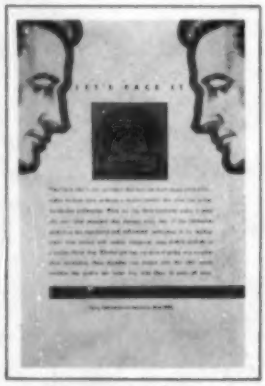

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